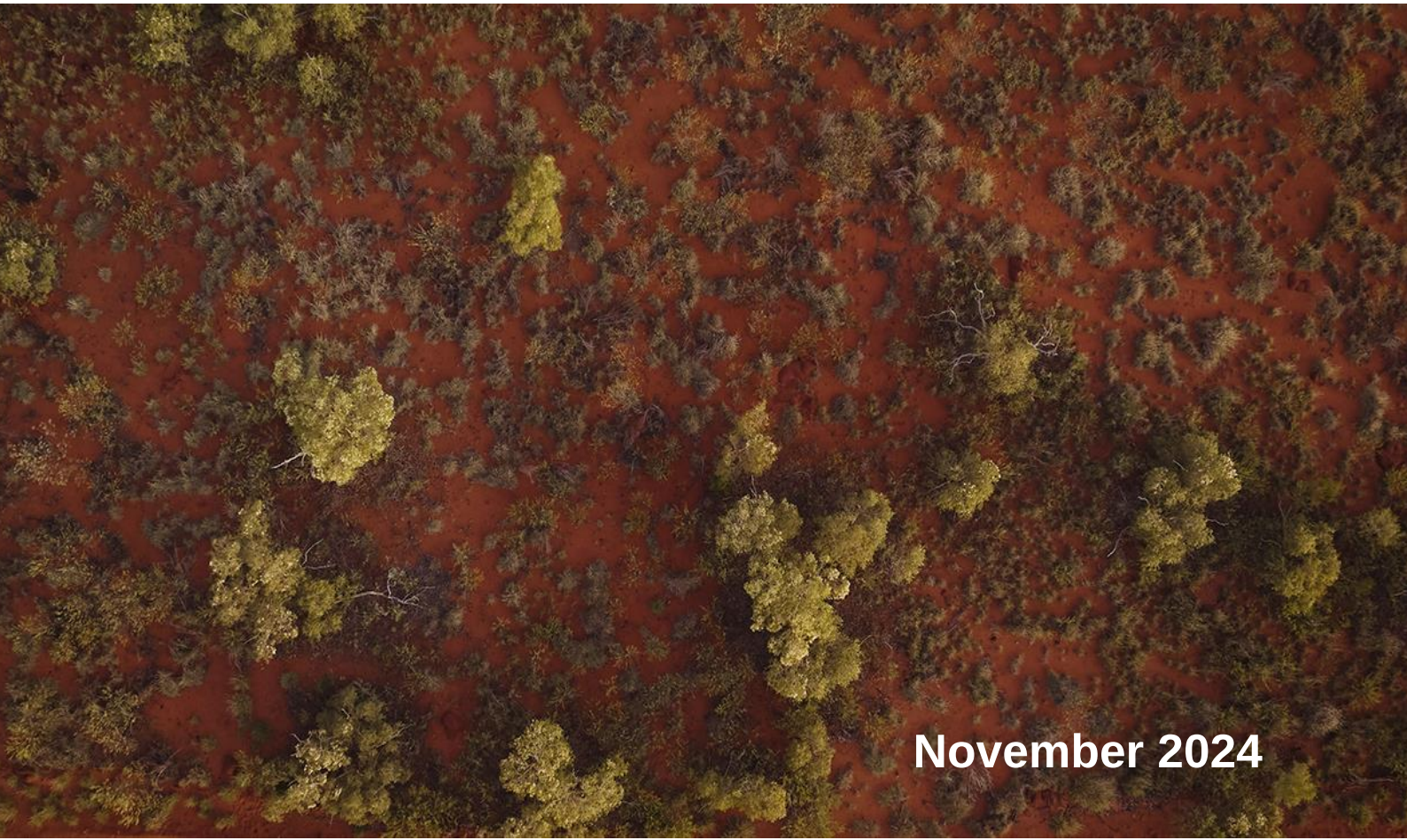
DE GREY MINING LTD

ENVIRONMENTAL MANAGEMENT PLAN

HEMI GOLD PROJECT



November 2024

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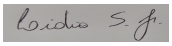
Prepared By	Lidio Junior	RPM Advisory Services Pty Ltd		11/10/2024
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RPMGLOBAL

Prepared for

DE GREY MINING LTD

EXECUTIVE SUMMARY

This Environmental Management Plan (EMP) has been developed by De Grey Mining Ltd (De Grey) for the Hemi Gold Project (the Proposal) to demonstrate how potential impacts on key environmental values will be managed and maintained. This EMP will support environmental assessment under the *Environmental Protection Act 1986* (EP Act) and has been written in accordance with the Environmental Protection Authority (EPA) guidelines (EPA, 2024). A summary of this EMP is provided in Table ES 1.

Table ES 1 EMP Overview

Proposal Title	Hemi Gold Project
Proponent name	De Grey Mining Limited
Ministerial Statement number	To be determined. The project is under assessment by EPA under the EP Act (assessment no. 2380) and by DCCEEW under the EPBC Act (assessment reference 2023/09556).
Purpose of the EMP	This EMP outlines the Proponent's management approach to protect the following environmental values: Terrestrial Fauna and Inland Waters (Potential Groundwater Dependent Vegetation).
Key environmental factor/s, outcome/s and/or objectives	Terrestrial Fauna: • Objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained. • Outcome: To ensure the Project is conducted in a manner that minimises direct and indirect impacts on the conservation of significant fauna, focusing on the following species: Greater Bilby and Northern Quoll. Inland Waters: • Objective: To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected. • Outcome: No direct or indirect impact from groundwater drawdown upon identified permanent and semi-permanent pools located along the Yule River attributable to the Proposal. • Outcome: The discharge of surplus mine dewater from the Proposal to the Turner River does not cause a significant long-term impact on Turner River riparian (mature tree) vegetation health.
Proposed construction date	Subject to approval, construction of the Proposal is planned to commence in ~2025 with mining scheduled to occur from ~2027 to ~2040.
EMP required pre-construction?	Yes

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Appendices

1. CONTEXT, SCOPE AND RATIONALE

De Grey Mining Limited (De Grey) is proposing to develop the Hemi Gold Project (the Proposal). The Proposal details are outlined in Section 1.1, while the environmental values associated with Environmental Factors are presented in Section 1.2.

To minimise environmental impacts from the Proposal, this Environmental Management Plan (EMP) identifies management criteria, monitoring procedures, and reporting requirements to ensure effective mitigation strategies are in place. The environmental values addressed in this EMP are as follows:

- Terrestrial Fauna:
  - Species protected under the *Biodiversity Conservation Act 2016* (WA) (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), and their habitat:
    - Greater Bilby (*Macrotis lagotis*) – BC Act and EPBC Act listed.
    - Northern Quoll (*Dasyurus hallucatus*) – BC Act and EPBC Act listed.
- Inland Waters/Groundwater Dependent Vegetation (GDV):
  - GDVs within the Turner River.
  - GDVs and pools associated with the Yule River.

This EMP has been developed in accordance with the Western Australia Environmental Protection Authority (EPA) guideline "*Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans*" (EPA, 2024). Therefore, it is expected to meet future conditions and will be subject to approval prior to implementation by the EPA.

1.1 Proposal

De Grey is the owner and proponent of the Proposal, which is located in Mineral Fields 45 and 47 in the Pilbara Region of Western Australia, 85 km south of Port Hedland in the Shire of the Town of Port Hedland (Figure 1-1).

Access to the site is via the Great Northern Highway. The Project is predominantly located on the Indee Station Pastoral Lease, with a small portion of the northern miscellaneous licences intersecting the Mundabullangana Station Pastoral Lease. The Project is on the lands of the Kariyarra People and in the Kariyarra Native Title determination area (Native Title Tribunal Number WCD2018/015). Native Title matters are managed by the Prescribed Body Corporate, the Kariyarra Aboriginal Corporation (KAC), based in Port Hedland. De Grey has executed a native title mining agreement with KAC.

The Project is a greenfield mine, and therefore, no existing mining or processing operations occur within the Development Envelope. Existing disturbance includes pastoral disturbance from pastoral tracks, water bores and cattle yards; and disturbance from exploration activities such as laydown areas, access roads and tracks, core yards, drill pads and sumps. The exploration activities are approved via Programs of Works (PoWs) issued by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) in accordance with the *Mining Act 1978* (Mining Act).

The Proposal involves the excavation of open pits, mine dewatering, and surplus water management, including reinjection and controlled discharge. Associated supporting infrastructure includes, but is not limited to an integrated waste landform (IWL) tailings storage facility (TSF), waste rock landforms

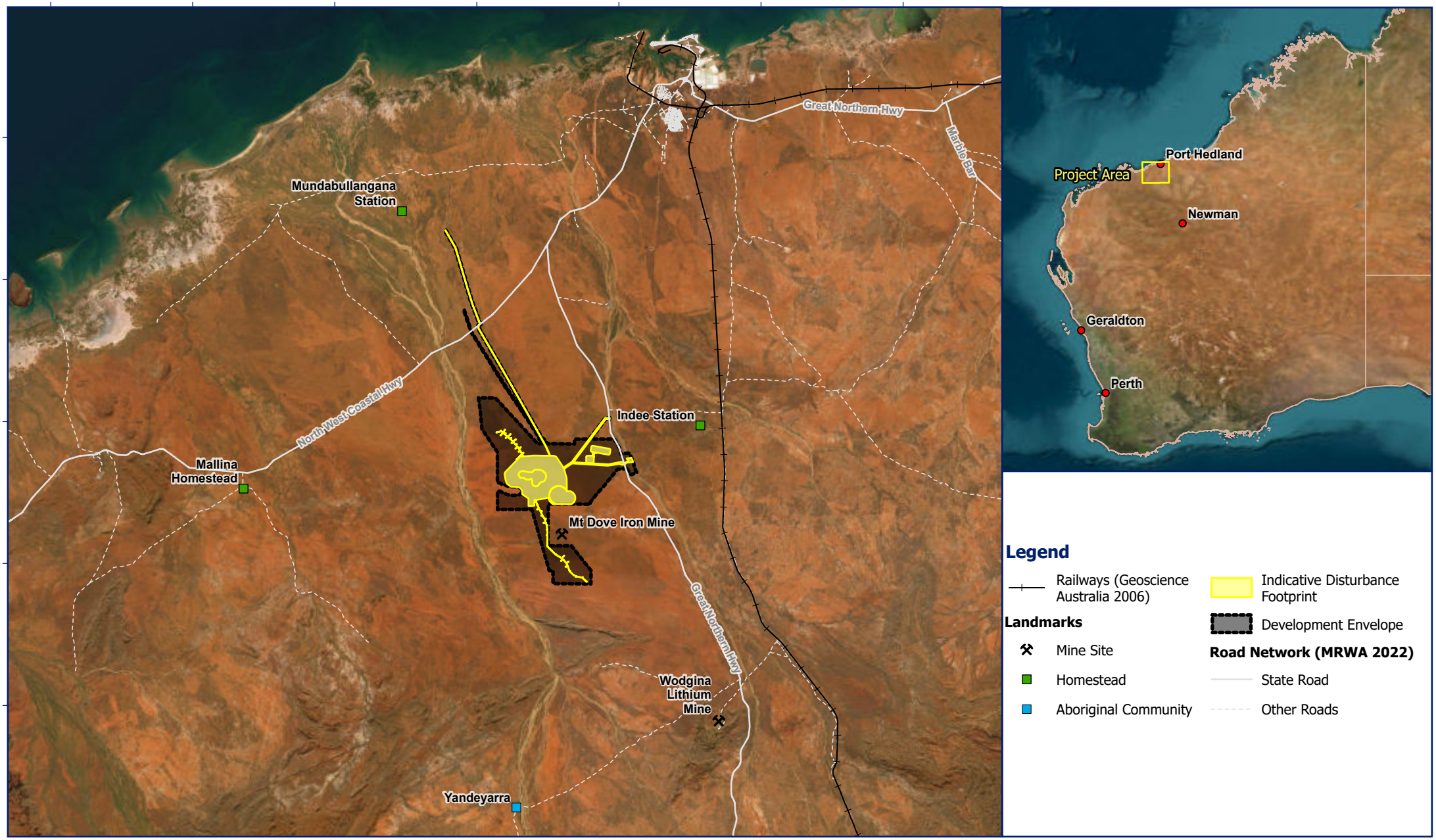
(WRLs), low-grade stockpiles, airstrip, accommodation village, sealed access and haulage roads, power and pipeline corridors, wastewater treatment plant (WWTP), and landfills.

The Proposal will commence with an approximately two-year period of dewatering, earthworks (including pre-stripping), and construction activities, followed by operational pre-strip mining and processing. Dewatering activities will be ongoing for the life of mine, with surplus water, not used in the proposed processing facility, to be reinjected into the upper and lower/paleochannel alluvial aquifers and/or discharged to the Turner River.

The total proposed disturbance area for the Project is anticipated to be up to 5,830 ha inside a Development Envelope of 22,194 ha.

The Proposal will proceed under the following Mining Act tenure:

- Mining Lease M47/1628 held by Last Crusade Pty Ltd, a wholly-owned subsidiary of De Grey.
- Miscellaneous Licences L45/600, L45/604, L45/605, L45/612, L47/1047, L47/1048, L47/1049, L47/966, L47/963, L45/642, L47/1069, L47/1070, L47/1071 held or submitted by De Grey.



Projection: GDA2020 MGA Zone 50

Created/Reviewed By: KM/EL

Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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PROJECT		CLIENT
April 2024	**Hemi Gold Project Environmental Management Plan**	DE GREY MINING LTD
Figure 1-1		
ADV-AU-00673	**Project Location**	

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1.2 Key Environmental Factors

This EMP addresses the key environmental factors relevant to the Proposal and the potential impacts of the Proposal that require management, as identified in the Referral Supporting Document (DEG-EN-RP-0009) for the EPA. The environmental values associated with the key environmental factors with the Project are presented in the subsections below, followed by the presentation of the potential direct and indirect impacts to them.

1.2.1 Terrestrial Fauna

Greater Bilby (*Macrotis lagotis*)

The Greater Bilby is listed as Vulnerable under the EPBC Act and BC Act. The vulnerable listing is due to fragmented distribution and limited area of occupancy. The species currently occupies 20% of its former range, with an estimated <10,000 mature individuals (TSSC, 2016a).

The range of the Greater Bilby extends from the inland regions of the Northern Territory to Northern and Central Western Australia, with one small known population in southwest Queensland. The remaining populations of the Greater Bilby occupy three main habitats (DCCEEW, 2023):

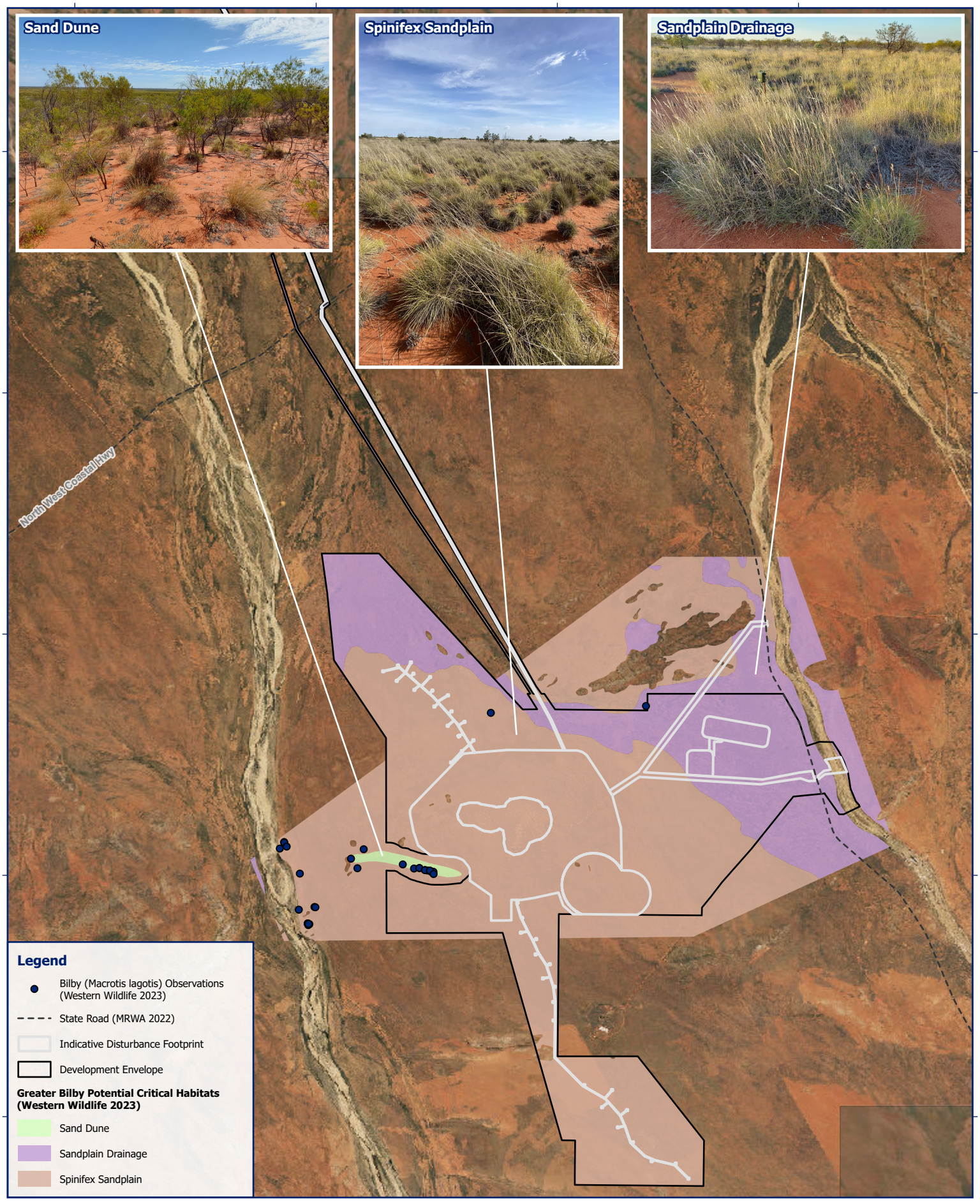
- Open tussock grassland on uplands and hills.
- *Acacia aneura* (mulga) woodland/shrubland growing on ridges and rises.
- Hummock grassland in plains and alluvial areas.

The habitat of the Greater Bilby varies across its range, so it is not possible to generate one description or definition of critical habitat (CoA, 2023). However, an interim guide, habitat critical to the survival of the Greater Bilby can be considered to include:

- Any area where the species is known or likely to occur as shown on the distribution map on the Greater Bilby Species Profile and Threats (SPRAT) Database.
- Any location outside the known or likely distribution where Greater Bilbies are found to occur.
- Any area between the areas noted above that may be periodically occupied by Greater Bilbies.
- Any area in which Greater Bilbies may naturally colonise or may feasibly be reintroduced.

The Department of Biodiversity, Conservation and Attraction's (DBCA's) Threatened and Priority Fauna database has several records of the Greater Bilby near the study area. As Greater Bilbies move their home range as food availability changes, local populations are not always present in an area even though critical habitat is present (Western Wildlife, 2023).

Secondary signs of the Greater Bilby were recorded during the initial field surveys commissioned by De Grey, primarily consisting of old burrows (inactive, but have been active in the past year). The burrows were recorded in the Sand Dunes and Spinifex Sandplain habitats, particularly in the vicinity of the Yule River. Therefore, Sand Dune, Spinifex Sandplain and Sandplain Drainage fauna habitat types have been classified as potential critical habitats in accordance with the criteria within the Greater Bilby National Recovery Plan. Unlike critical habitat for other species, Greater Bilby critical habitat is often widespread and, in this case, extends well beyond the study area. Greater Bilby critical habitat and records are shown in Figure 1-2. A total of 15,809.8 ha of Spinifex Sandplain and 6,029.4 ha of Sandplain Drainage potential critical habitat occurs within the Development Envelope, of which an upper limit of clearing of 5,100 ha and 800 ha, respectively, is proposed.



Projection: GDA2020 MGA Zone 50

Scale: 1:200,000

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Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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PROJECT

Hemi Gold Project
Environmental Management Plan

Greater Bilby Records and Potential Critical Habitat

Figure 1-2 | ADV-AU-00673 | November 2024

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Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll is listed as Endangered under the EPBC Act and BC Act, occurring across northern Australia. The species population has declined 50% over the last decade, now occurring as several disjunct populations (Western Wildlife, 2023). Recent studies have shown that the Northern Quoll forms two subpopulations in the Pilbara with a great deal of mixing between them, indicating that the species has a large capacity for dispersal.

The Northern Quoll occurs in various habitats across its range, with the Pilbara populations favouring dissected rocky escarpments. Habitat described as critical to the survival of Northern Quoll (critical habitat) includes:

- Offshore islands where the Northern Quoll is known to exist.
- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines.
- Structurally diverse woodland or forest areas containing large-diameter trees, termite mounds or hollow logs.
- Dispersal and foraging habitat associated with or connecting populations important to the long-term survival of the Northern Quoll.

Little is known about Northern Quoll foraging and dispersal habitats; however, the EPBC Act referral guidelines recognise that all native vegetation within 1 km of shelter habitat or Northern Quoll records may be considered foraging and dispersal habitat (DoE, 2016).

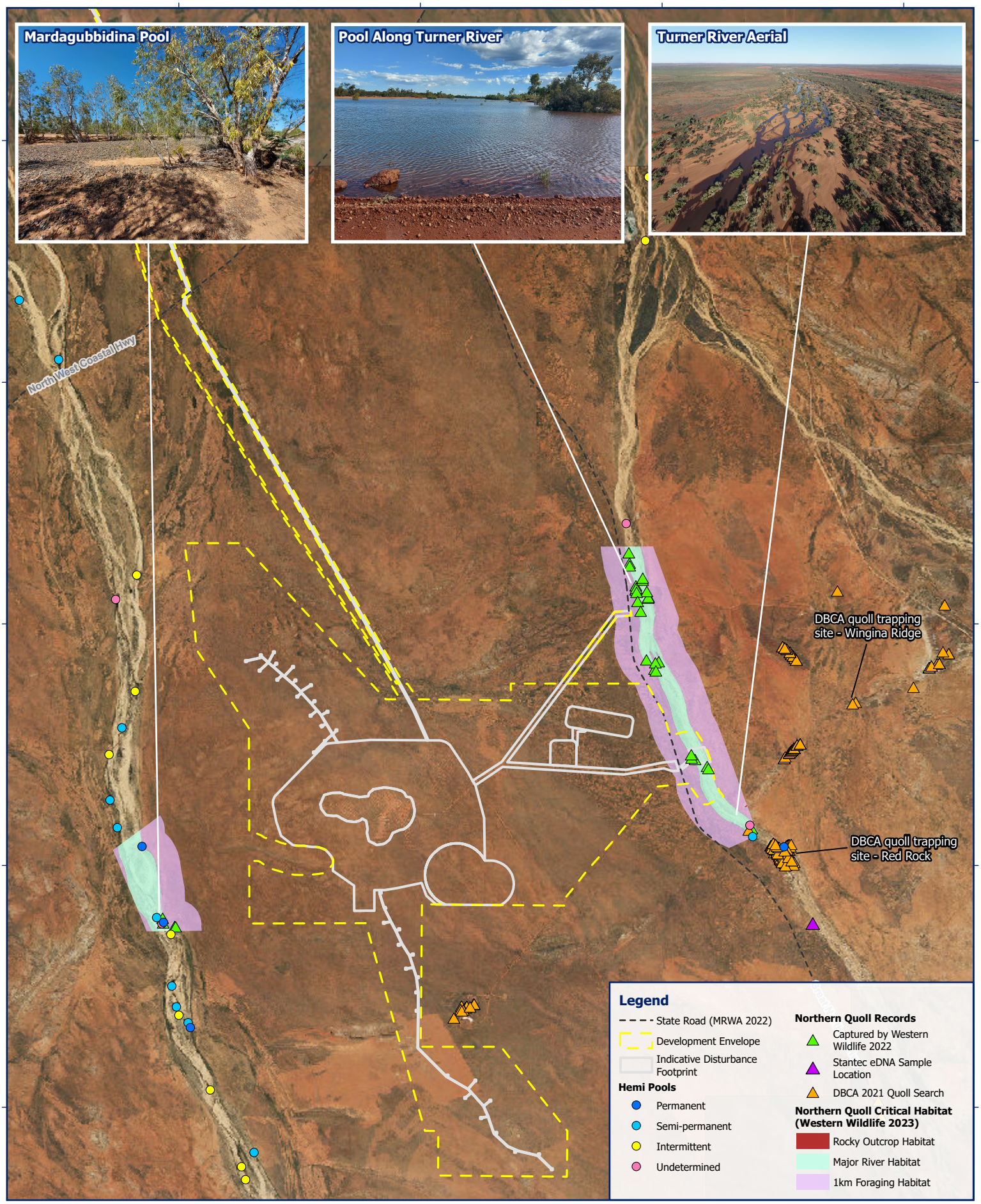
The Major River habitat is likely to be important for foraging and dispersal as it contains tree hollows for shelter, and the presence of water provides a high-productivity foraging environment. Breeding is restricted to Rocky Outcrops only. Foraging and dispersal habitat within 1 km of these habitats is also considered potentially critical habitat based upon referral guidelines for the Northern Quoll.

The DBCA has been monitoring a Northern Quoll population at the Indee station adjacent to the Project since 2013, with trapping sites established 1 km east of the Development Envelope at Wingina Ridge and Red Rock (Western Wildlife, 2023). This population is classified as an 'Important Population' by DBCA due to its significance for the long-term persistence of the Northern Quoll. Data from multiple studies indicate that the Northern Quoll population extends eastward beyond the Development Envelope, with captures of Northern Quolls at Wingina Ridge adjacent to the eastern boundary and Red Rock further southeast (Western Wildlife, 2023).

Given the contiguous habitat, the Northern Quolls recorded by the baseline survey within the study area likely form part of this important population monitored by DBCA. These capture records, along with the presence of suitable habitat, suggest the contiguous habitat for this important population extends eastward from the Project (Western Wildlife, 2023).

Western Wildlife survey records and DBCA records within a 20 km buffer and critical habitats of the survey area are shown in Figure 1-3. A total of 181.2 ha of potential critical habitat occurs within the Development Envelope, of which an upper clearing limit of 45 ha is proposed within the provisional disturbance footprint. A further 41 ha of potential critical foraging habitat is proposed to be cleared adjacent to the Turner River.

It should be noted that potential pools, as mapped by De Grey, associated with both the Yule and Turner River systems have been considered important habitat features for the Northern Quoll and, to a lesser extent, the Greater Bilby. A level 3 Environmental Risk Assessment undertaken for the discharge of surplus groundwater to the Turner River has been completed by MBS (2024). A regional approach has been undertaken to define water quality triggers and threshold criteria for elements that occur in groundwater at higher concentrations than surface water to ensure ecological values in the form of pools and groundwater dependent vegetation remain intact.



Projection: GDA2020 MGA Zone 50

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Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Hemi Gold Project
Environmental Management Plan

Northern Quoll Records and Potential Critical Habitat

Figure 1-3	ADV-AU-00673	November 2024

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1.2.2 Inland Waters

The Project is situated on a relatively flat plain not crossed by any tributaries or creeks, within an internal catchment between the Yule River and Turner River catchments. Both rivers hold significant environmental values and social values.

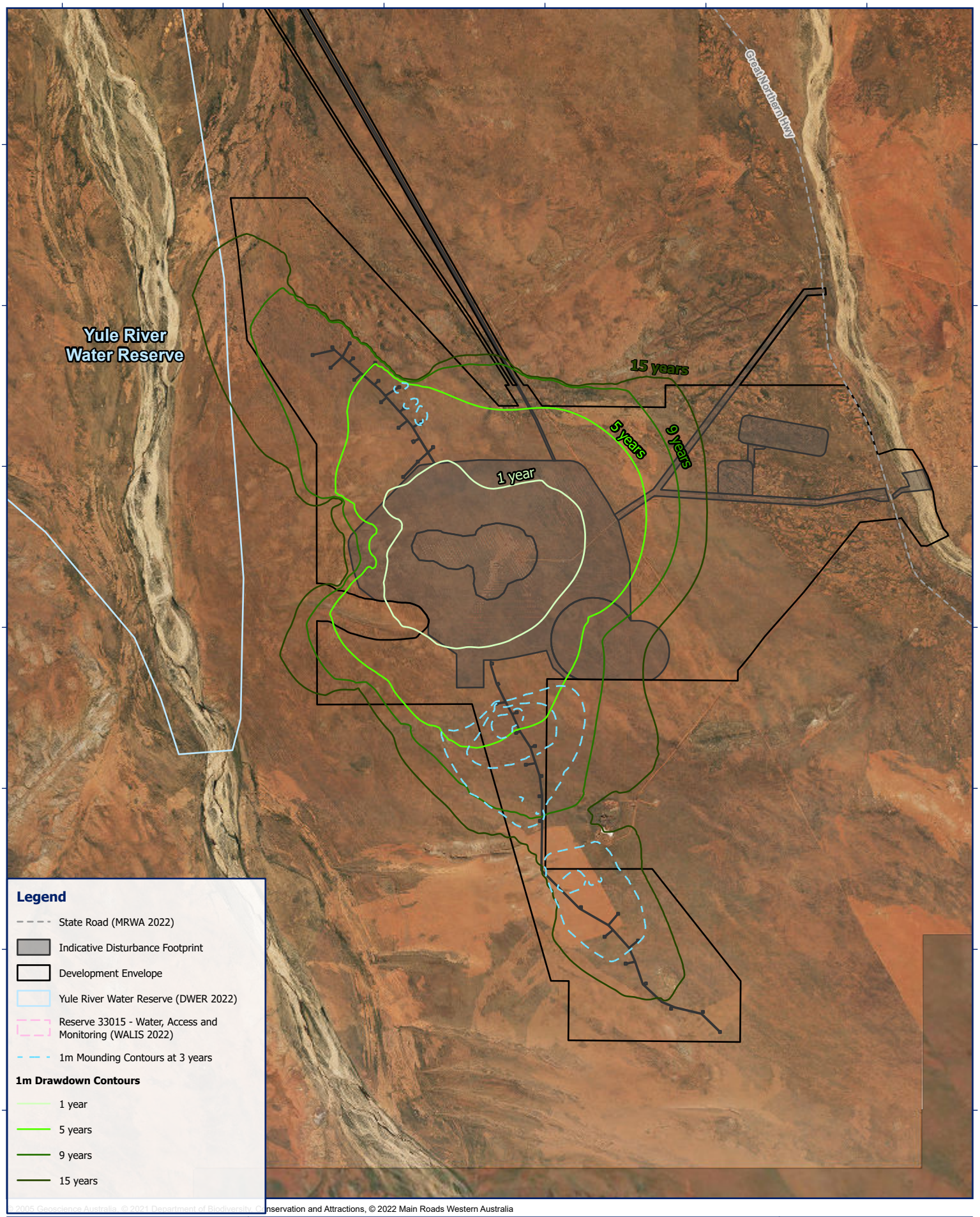
The Yule River resides west of the Development Envelope. Permanent pools within the river support riparian and groundwater-dependent vegetation (GDV). These pools also hold cultural significance for Traditional Owners. Additionally, the shallow alluvial aquifer beneath the Yule River serves as a source of stock water and supplies drinking water for the town of Port Hedland via a borefield situated downstream and outside the Project's influence area.

The Turner River shares similar flow characteristics with the Yule River; however, it possesses a smaller catchment area. Similar to the Yule River, the Turner River contains semi-permanent pools, including Kunagunarinna Pool (upstream) and Moorambine Pool (downstream). Moorambine Pool is located approximately 40 km downstream, within the section of the river that will receive surplus discharge water. The Turner River also sustains riparian and potential GDVs and is used for various purposes like stock watering, domestic needs, and limited mining activities.

Due to its distance, the Project's dewatering, reinjection and discharge activities are not expected to reach the Yule River. The modelled water drawdown contours over the Project’s life, which already account for the mounding area around the reinjection borefield areas are presented in Figure 1-4. Recognising the importance of these semi-permanent and permanent pools within the Yule River for maintaining ecological values and cultural significance, an outcome-based provision is proposed to manage potential impacts. This provision will utilise a three-tiered approach with early warning bores, trigger bores, and threshold bores. Early warning bores will provide an initial indication of potential drawdown approaching. Trigger bores will signal the need for investigation and potential mitigation measures if drawdown reaches a predetermined level. Finally, threshold bores will indicate if intervention strategies are necessary to protect the ecological and cultural values of the pools.

The Turner River will receive intermittent discharges of surplus water during the initial project years, potentially continuing at lower volumes throughout the Project's lifespan. This discharge will cause a temporary shift from the river's seasonal flow to a more continuous one, particularly near the discharge point. The majority of the surplus water discharge area is expected to be shallow, with most depths (91%) reaching under 40 cm and covering a narrower section compared to the natural riverbed.

An outcome-based approach for surplus water discharge quality will be defined, alongside objective-based provisions for monitoring the Turner River's ecosystem. This strategy will address potential ecological risks, including the need for specific management measures to mitigate contaminants presence.



Legend

- State Road (MRWA 2022)
- Indicative Disturbance Footprint
- Development Envelope
- Yule River Water Reserve (DWER 2022)
- Reserve 33015 - Water, Access and Monitoring (WALIS 2022)
- 1m Mounding Contours at 3 years

1m Drawdown Contours

- 1 year
- 5 years
- 9 years
- 15 years

Scale: 1:150,000

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Projection: GDA2020 MGA Zone 50

Created/Reviewed By: KM/EL

Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Hemi Gold Project
Environmental Management Plan

Groundwater Drawdown and Mounding

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Figure 1-4	ADV-AU-00673	November 2024

1.2.3 Potential Direct and Indirect Impacts

Table 1-1 outlines the potential direct and indirect environmental impacts on the environmental values identified in the previous sections. Understanding the potential consequences resulting from the impacts was used to develop the environmental objectives and outcomes described in Section 2.

Table 1-1: Potential direct and indirect environmental impacts on key environmental values

Environmental Value (environmental receptor)	Proposal Activities and Potential Impacts	
	Direct	**Indirect**
Terrestrial Fauna		
Greater Bilby (*Macrotis lagotis*)	• Habitat loss (removal/clearing of critical habitat). • Loss or injury of individuals during clearing. • Accidental vehicle strikes.	• Introduction and increase in predation by foxes and cats. • Changes in fire regime and intensity due to landscape changes and mine operations. • Loss of traditional owner knowledge and land management (loss of cultural values). • Reduction of habitat quality in the surrounding area.
Northern Quoll (*Dasyurus hallucatus*)	• Habitat loss (removal/clearing of critical habitat). • Accidental vehicle strikes. • Loss or injury of individuals during clearing.	• Introduction and increase in predation by feral predators (foxes and cats). • Introduction of cane toads. • Changes in fire regime and intensity due to landscape changes and mine operations. • Reduction of habitat quality in the surrounding area.
Inland Waters		
Turner River and its ecosystem (impacts associated with the discharge of surplus water)	• Impact on the riparian vegetation. • Changes in the wet/dry cycle along the river. • Changes to the water quality of the river.	• Changes to surface water streamflow decreasing general environmental quality. • Erosion of riverbanks and changes to geomorphology with the potential to promote invasive weed species growth and feral herbivore species. • Impacts on aquatic ecology due to changes in water quality.
Groundwater (impacts associated with dewatering and reinjection activities)	• Impact on GDVs along the Yule and Turner riverbeds and banks. • Changes to groundwater availability, quality and hydrogeological flow.	• Groundwater mounding at reinjection borefields. • Decline in groundwater quality in paleochannel aquifer due to reinjection of unsuitable quality surplus water. • Drawdown impacts third-party yield bores in the vicinity.

1.3 Condition Requirements

This management plan is being provided to support the environmental assessment of the Project. The assessment is mandated by Section 38 of the *Environmental Protection Act 1986*. Considering the information provided in the updated Referral Supporting documents for the EPA, this EMP proposes environmental management and monitoring to ensure environmental outcomes and objectives are achieved.

1.4 Rationale and Approach

This EMP draws upon various sources to establish management measures that will achieve environmental objectives for each key factor. These sources include:

- Findings from surveys and studies.
- Identification of key assumptions and any uncertainties.
- Scientific knowledge specific to the site and the broader region.
- An analysis of the impacts, considering intensity, duration, magnitude, and overall footprint.
- Recognition of potential environmental changes that may occur.
- Consideration of external factors that may influence the Project.
- A defined timeframe for implementing mitigation strategies.

1.4.1 Survey and Study Findings

Table 1-2 displays the baseline surveys and studies that have been taken into account while developing this EMP. Details of the survey findings are presented in the updated Referral Supporting Document (De Grey, 2023).

Table 1-2: Surveys and Studies Relevant to this EMP

Factor	Survey / Study Title	Description
Terrestrial Fauna	Detailed Vertebrate Fauna Survey 2021-2024 (Western Wildlife, 2024).	Two-phase detailed fauna survey conducted in September 2021, March 2022 (with supporting data collected in August 2022) for all fauna species, as well as a basic survey of the proposed infrastructure corridors. Additional targeted survey for Northern Quoll, Greater Bilby and Night Parrot in April 2024.
	Additional targeted surveys at Hemi for Greater Bilby, Quoll and Night Parrot (Western Wildlife, 2024)	A seven-day ecological survey targeting specific species.
Inland Waters	Baseline Aquatic Ecology Study of the Turner and Yule Rivers (Stantec, 2022).	A baseline aquatic ecology survey that presents the ecological values of the Turner and Yule Rivers. This survey also identified terrestrial vertebrate species along the Yule and Turner Rivers.

Factor	Survey / Study Title	Description
	Groundwater and Surface Water Assessment (Geowater, 2023).	Comprehensive groundwater (hydrogeological) and surface (hydrological) water modelling.
	Turner River Dewater Discharge Tier 3 Environmental Risk Assessment (MBS, 2024)	A Tier 3 environmental risk assessment to evaluate the impacts of discharging of raw and treated dewatered water into the Turner River.

1.4.2 Key Assumptions and Uncertainties

This EMP includes management provisions addressing key assumptions and uncertainties related to Proposal implementation, as well as the significance and potential impacts of the main environmental factors.

The key assumptions include:

- Hydrological modelling and past monitoring data provide an indicative estimate of natural low flows in the Turner River for surplus water discharge. The hydrological model will be reviewed as more data becomes available, and management measures may be adjusted if required.
- Groundwater modelling provides a good estimate of the extent and depth of groundwater drawdown. The model will be updated as more data becomes available, and management measures may need to be adjusted.
- Protecting high-value habitat will allow threatened species to persist within the Development Envelope.
- Baseline surveys provide representative species lists.
- All remnant vegetation around the proposal provides habitat for conservation-significant fauna and connects them throughout the Development Envelope and beyond.
- Feral predators cannot be completely eradicated from areas surrounding the Development Envelope as they will move in from neighbouring areas.
- Rehabilitation of disturbed areas will happen progressively, minimising habitat fragmentation and restoring connectivity as soon as reasonably practicable. Rehabilitation will include specific measures to re-establish flora and vegetation values according to the Mine Closure Plan, which will, in turn, provide important fauna habitat for conservation-significant species.

The key uncertainties include:

- Expected daily discharge volumes do not account for short-term events (e.g., rain events or emergencies that may disrupt operations).
- Riparian and groundwater-dependent vegetation responses to combined stressors, like groundwater extraction, climate variability, and surplus water discharge.
- Limited data exists on the sensitivity of threatened species to light, noise, and vibration, as well as on the likely impacts of climate change and drought on these species.
- External factors, such as bushfires and occasional tropical storms, can influence environmental monitoring results and the ability to meet environmental targets. These factors should be considered during data interpretation and when evaluating compliance with environmental criteria.

1.4.3 Management Approach

This EMP has been created to manage the key environmental values following a risk-based approach and then applying the mitigation hierarchy of avoid, minimise, rehabilitate, and offset. Where impacts cannot be fully avoided, measures will be implemented to minimise the severity and duration of the impacts. Following construction and operation, this EMP will guide rehabilitation efforts to restore habitat and baseline environmental conditions. As a last option, significant residual impacts may be offset through payments to the Pilbara Environmental Offset Fund (PEOF).

Potential impacts were identified based on extensive experience in mine site management, considering all the baseline studies and stakeholder consultations undertaken for the Project. Moreover, the findings of the baseline studies and consultation were also used to prioritise mitigation and management actions. While many of the management provisions are commonly used in mine sites across Western Australia, De Grey specifically developed some provisions for the Proposal.

1.4.4 Rationale for Choice of Provisions

This EMP employs a holistic approach to achieving environmental outcomes and objectives for each key factor. The specific provisions chosen are based on a thorough evaluation of the following:

- Baseline Data and Project Details:
  - Findings from dedicated surveys, including local and regional data;
  - Project parameters and footprint; and
  - The presence of significant conservation species and their habitat suitability.
- Risk Assessment:
  - Significance of potential impacts on environmental values;
  - Threatening processes and risks specific to conservation-significant species; and
  - Presence of MNES.
- Scientific Knowledge and Best Practices:
  - Established scientific information for the site and surrounding region; and
  - Industry best practices for minimising impact and promoting successful rehabilitation.
- Monitoring and Measurement Strategies:
  - Availability of suitable monitoring methods;
  - Defined environmental criteria and management targets to assess performance; and
  - Monitoring methods and reporting frequency for compliance assessment.

This combination of factors ensures the chosen provisions are targeted, measurable, proactive and adaptive. The specific provisions for each environmental factor, along with their justification and related monitoring measures, are detailed in Section 2.

2. ENVIRONMENTAL MANAGEMENT PLAN PROVISIONS

This section outlines the provisions that De Grey will undertake to achieve the environmental objectives and outcomes established for the construction and operation phase of the Project. The objective and outcome-based provisions are tailored to address specific environmental factors and are presented from Table 2-1 to Table 2-6. Nevertheless, the provisions presented align with the:

- Recovery Plan for the Greater Bilby (*Macrotis lagotis*) (DCCEEW, 2023b); and
- National Recovery Plan for the Northern Quoll (*Dasyurus hallucatus*) (Hill & Ward, 2010).

To ensure ongoing effectiveness, this EMP will follow an adaptive management approach. Details can be found in Section 4.

Apart from that, the Greater Bilby Disturbance Protocol (DEG-EN-RP-0003) for the Hemi Gold Project (Appendix 1) outline operational measures to protect the Greater Bilby (*Macrotis lagotis*) during all phases of vegetation clearing and mining activities. These protocols include pre-clearing surveys to identify active and inactive burrows, detailed displacement and capture-and-release procedures to ensure bilbies are safely relocated to suitable habitats, and post-clearing monitoring to assess the effectiveness of these measures and prevent re-occupancy of cleared areas.

These protocols complement the strategic objectives of the Conservation Significant Species Management Plan (CSSMP) (DEG-EN-RP-0002) by minimising direct and indirect impacts on Greater Bilby populations. They were designed in accordance with the Department of Biodiversity, Conservation and Attractions (DBCA) guidelines, industry best practices and scientific knowledge on the topic.

2.1 Objective Based Criteria

Objective-based management actions and targets are outlined in Table 2-1. Management actions specified in the provisions tables for each species are commensurate with their conservation significance and the potential impact(s) of the Proposal.

Table 2-1: Objective Based Provisions - Terrestrial Fauna

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.' **Overarching outcome:** To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll **Key environmental values:** Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).				
Management Targets	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Prevent the loss of Greater Bilby and Northern Quoll individuals within the Development Envelope				
Key impact: Mortality of individuals due to land clearing for the Proposal				
No mortalities of Greater Bilby or Northern Quoll individuals from land clearing activities.	• Training and awareness of internal ground disturbance procedure and known conservation significant fauna. • Implement the site clearing procedure, including: – Review of significant fauna register to identify any recent significant fauna observations. – Survey and demarcation of proposed clearing areas. – Pre-clearance searches to identify the presence of Northern Quoll. – Pre-clearance inspections for the Greater Bilby to be undertaken in accordance with the Greater Bilby Disturbance Protocol (DEG-EN-RP-0008). – Clearing activities to occur during day light hours, where practicable. – Clearing to be undertaken progressively, where reasonably practicable, to minimise active disturbance. – Clearing will commence, where reasonably practicable, from a disturbed vegetation edge to an undisturbed area (to encourage mobile fauna to relocate to adjacent areas naturally). • A suitably qualified fauna spotter to be present during land clearing activities, where required. • If injured/sick animals are encountered, a nominated fauna carer listed under the Pilbara Wildlife Carers Association will be called to care for the animal.	• Employee training records. • Environmental compliance inspections. • Fauna register • Annual desktop review of areas cleared against areas approved.	• Prior to clearing during construction and operational phases of the Project. • During clearing.	• Mortalities reported to DBCA within 5 business days. • Where practicable, DNA samples to be collected and preserved for DBCA/WA museum analysis. • Annual Environmental Report.

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.' **Overarching outcome:** To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll **Key environmental values:** Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).				
Management Targets	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Avoid and minimise impacts to potential critical habitat during construction and operational phases.				
Key impact: Loss of habitat due to the Proposal				
Limit clearing of critical habitat for the Greater Bilby and Northern Quoll.	• Spatial data of current significant fauna habitats and sightings to be maintained (Fauna Register) and used in planning clearing activities. • Clearing limited to no more than: – 5,830 ha within the Development Envelope. – 5,100 ha of Spinifex Sandplain habitat within the Development Envelope, which is considered a potential critical habitat for the Greater Bilby. – 800 ha of Sandplain Drainage habitat within the Development Envelope, which is considered a potential critical habitat for the Greater Bilby. – 45 ha of Major River habitat within the Development Envelope, which is considered a potential critical habitat for the Northern Quoll. • Minimise clearing of critical habitat to as low as reasonably reasonably practicable. • Disturbance to be progressively rehabilitated, where reasonably practicable.	• Annual aerial capture of areas cleared against critical habitat (satellite or Remotely Piloted Aircraft). • Environmental compliance inspections. • Clearing and fauna registers. • Clearing supervised by environmental personnel.	• Prior to all clearing during the construction and operational phases of the Project. operations. • Annual reconciliation of critical habitats cleared.	• Annual Environmental Report. • Mine Rehabilitation Fund (MRF) (WA). • Impact Reconciliation Report.
Limit the reduction of habitat quality due to surplus water discharge	• Construct settling ponds (water treatment) to reduce concentrations of naturally elevated elements of concern below established thresholds before discharge. • Establish and adhere to strict discharge criteria for all parameters relevant to maintaining habitat quality. • Discharge and monitoring undertaken in accordance with a Part V EP Act Environmental Licence.	• Implement water quality monitoring. • Implement habitat monitoring using biological indicators and assessing vegetation health. • Monitoring undertaken as per Environmental Licence to be issued under Part V EP Act (WA).	• Settling ponds (water treatment) to operate continuously throughout the discharge period. • Discharge monitoring frequency will depend on the regulatory requirements.	• Annual Environmental Report. • As required by the Site Environmental Licence.

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.' **Overarching outcome:** To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll **Key environmental values:** Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).				
Management Targets	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Improvement to remaining habitat by managing key threats				
Key impact: Fire resulting from Proposal activities				
Minimise accidental bushfires within the Development Envelope as a result of the construction and operation of the Proposal.	• Conduct site inductions that include fire prevention and control measures. • Appropriate firefighting equipment is to be available to control localised outbreaks of fire. • Regular inspection and maintenance of firefighting equipment will be implemented to comply with relevant fire safety standards. • Emergency response (firefighting) procedures are to be implemented to control fires that arise from the implementation of the Project. • Hot work permit system required to authorise all work scopes that are likely to produce a source of ignition (e.g., cutting, grinding, welding etc.). • No unauthorised off-road driving to prevent vehicles and machinery from igniting grassfires. • All vehicles will carry portable fire extinguishers, with training provided on fire-fighting equipment.	• Induction and training records. • Inspection of firefighting equipment to ensure availability and compliance with fire safety standards. • Inspection of hazard/incident records. • Inspection of permit-to-work system records.	• Annual or as appropriate during the life of mine.	• Annual Environmental Report.

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.' **Overarching outcome:** To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll **Key environmental values:** Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).				
Management Targets	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Key impact: Weeds resulting from Proposal activities				
Target and manage existing or emerging weed populations as a result of the Proposal	• Implementation of vehicle and equipment hygiene measures. Equipment hygiene and inspection certificate required for all earth-moving vehicles, heavy machinery and drill rig equipment entering and leaving the Development Envelope or moving between identified weed infestation areas to areas that are not infested. • No transfer or relocation of material potentially harbouring weeds/weed seeds is permitted from identified weed-infested areas to areas with no/low weed infestation (e.g., transfer of topsoil). • Infested or potentially infested material will be quarantined in areas with existing infestations. • No materials or fill brought to the site unless certified clean. • Implement weed control as required. • All site personnel to be informed during their site induction of the risk of weeds and requirements for weed management to ensure risk of introduction and weed spread are minimised. • Presence of weeds included in environmental hazard and housekeeping inspections.	• Environmental inspection records of earth-moving equipment and hygiene certificates. • Inspections to assess material storage. • Induction presentations, materials, and records. • Targeted monitoring and management in high-risk areas.	• Inspection of earth moving equipment and hygiene certificates will be undertaken for the life of the Proposal. • Annual inspections or as appropriate during the life of mine. • Weed control as required.	• Annual Environmental Report. • The 12 first months from commencement of construction phase will be assumed as baseline conditions.

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.'
Overarching outcome: To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll
Key environmental values: Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).

Management Targets	Management Actions	Monitoring	Timing / Frequency of Actions	Reporting
Prevent deaths or injuries of Greater Bilby and Northern Quoll by managing key threats				
Key impact: Feral predators resulting from Proposal activities				
Target and manage existing or emerging feral fauna populations as a result of implementation of the Project.	• All site personnel to be informed during their site induction of potential feral animal species (including feral cats, European Red Fox and cane toad) that may occur on site, and requirement to report sites immediately to site environmental representative. • Feral animal presence will be discouraged on site by: – Prohibiting feeding animals. – Prohibiting keeping pets. – Appropriate waste disposal for food scraps and other wastes. – Preventing the attraction of feral predators to the area by reducing access to food and water sources and fencing of water sources and landfill. • Report sightings of feral fauna by personnel as environmental incidents in the incident register. • If required, control existing populations through baiting, shooting, and trapping.	• Camera monitoring, where required. • Environmental incident records. • Maintain feral sights records. • Induction presentation, materials and records. • Inspection of waste disposal areas.	• Annual or as appropriate during the life of mine. • Control as required.	• Annual Environmental Report. • Assume the first 12 months of monitoring as baseline conditions for the project.
Key impact: Cane toads resulting from Proposal activities				
No cane toads introduced as a result of Project activities.	• Prevent the introduction of cane toads by implementing more rigorous vehicle hygiene measures for vehicles arriving from known cane toad ranges (Kimberley, Northern Territory). • Include in contractor pre-mobilisation information that vehicles travelling to the Development Envelope from known cane toad ranges may be required to undertake quarantine requirements. • Site inductions will include cane toad identification and reporting of sightings. • Humane disposal of any cane toads found.	• Environmental induction records. • Environmental incident records. • Vehicle inspection records. • Contractor pre-mobilisation records for vehicles entering from known cane toad ranges.	• Annual or as appropriate during the life of mine. • Part of induction process for new personnel accessing the site.	• Annual Environmental Report. • Confirmed sightings reported on feralscan.org.au/toadscan and to DBCA and other relevant authorities.

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.' **Overarching outcome:** To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll **Key environmental values:** Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).				
Management Targets	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Key impact: Direct strikes from vehicle and machinery movement				
Minimise mortalities of Greater Bilby or Northern Quoll individuals due to vehicle movement.	• Induction will include site speed limits, identification and significance of Greater Bilby, Pilbara Olive Python, Night Parrot, Grey Falcon and Northern Quoll, and reporting requirements for vehicle impacts. • Vehicles and machinery are to remain on designated roads unless in the case of an emergency or when undertaking pre-authorised activities. • Implement speed limits within the Development Envelope based on a risk assessment that considers environmental values (in addition to safety/other required legislation). • Roads and tracks signposted with speed limits and warnings of fauna in areas identified as having high value conservation significant fauna.	• Speed signage in place. • Fauna signs in place. • Environmental induction records. • Environmental incident records. • Inspection of incident records	• Annual or as appropriate during the life of mine.	• Mortalities reported to DBCA within 5 business days. • Annual Environmental Report.

Objective: 'To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.' **Overarching outcome:** To ensure the Proposal is carried out in a manner that minimises direct and indirect impacts on the Greater Bilby and Northern Quoll **Key environmental values:** Greater Bilby (*Macrotis lagostis*) and Northern Quoll (*Dasyurus hallucatus*).				
Management Targets	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Key Impact: Fauna Encounters/Interactions				
Avoid direct or indirect deaths or injuries of conservation significant fauna due to Project activities.	• All site personnel to be informed during their site induction of conservation significant fauna species (Greater Bilby, Pilbara Olive Python, Night Parrot, Grey Falcon and Northern Quoll) that may occur on-site, associated high-value habitats and measures to be taken to minimise impacts to these values. • Any EPBC and BC Act listed threatened species encountered on site are to be recorded and records maintained for the Project. This will include locations, and animal status (alive/dead). EPBC and BC Act listed threatened species' injury or fatality to be documented as an incident. • If EPBC or BC Act listed threatened fauna species are required to be moved, fauna are to be handled and transported in accordance with the requirements of the BC Act. • Feeding of native fauna, hunting, keeping of firearms or pets on site is prohibited. • Barbed wire use is to be avoided in the Development Envelope, except where there is a legislative requirement to do so. Where barbed wire is required by legislation, reflectors are to be installed on the barbed wire. • Establish egress points in artificial water sources (e.g. turkeys' nests, sediment ponds and borrow pits)	• Inspection of records, related to sightings, records, encounters and fauna removal. • Inspections to assess whether any unauthorised barbed wire is being utilised on site. • Inspection of barbed wire installation to ensure reflectors are in place. • Training records.	• Annual or as appropriate during the life of mine.	• Annual Environmental Reporting.

2.2 Outcomes Based Criteria

Criteria have been developed to prevent (trigger criteria) and mitigate (threshold criteria) any potential impacts. For the outcome related to water drawdown, early response has also been established to provide an additional layer of protection. However, for the surplus water discharge outcome, the focus will be on trigger and threshold criteria to ensure water quality is maintained. Table 2-2 to Table 2-6 outlines the outcomes-based provision and response actions.

Table 2-2: Outcomes Based Provisions – Inland Waters: Groundwater Drawdown Extension and Surface Water Discharge Quality

EPA factor/s and objective/s: Inland Waters: 'To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.' **Objective/s:** No significant impact on the Yule and Turner River ecosystems. **Key environmental values:** Potential GDV, aquatic fauna and pools associated with the Yule River.				
Indicators	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
No indirect impact from groundwater drawdown upon identified permanent and semi-permanent pools located along the Yule River attributable to the Proposal. Reference and monitoring sites are shown in Figure 2-1				
Early Response Criteria				
Groundwater levels at bores identified in Table 2-3 fall below early response criteria (3 m less than natural variation observed, with natural variation being 2 m) as a result of Proposal activities.	If three consecutive monthly exceedances are observed within a bore, breaching the "early response" level, De Grey will: • Conduct a review and revision of the conceptual hydrogeological model, including planning for additional monitoring bores if determined appropriate for improving conceptualisation. • Determine if water level declines can be attributed to activities associated with the Project (i.e., dewatering) and are consistent with expected trends. • Review whether any other environmental factors, i.e., land use changes or climate-driven changes, can be attributed to the change in trends against reference bores. • Review any abstraction rates to determine whether additional dewatering optimisation can be undertaken. • Install (if required) or review additional monitoring bores and incorporate them into the conceptual model. • Investigate whether additional Managed Aquifer Recharge (MAR) is required. • Review existing trigger and threshold criteria and update as appropriate.	• Groundwater level in monitoring bores as per Table 2-3.	• Monthly	• N/A

EPA factor/s and objective/s: Inland Waters: 'To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.' **Objective/s:** No significant impact on the Yule and Turner River ecosystems**.** **Key environmental values:** Potential GDV, aquatic fauna and pools associated with the Yule River.				
Indicators	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Trigger Criteria				
Groundwater levels at bores identified in Table 2-3 fall below trigger criteria (2.5 m less than natural variation observed) as a result of Proposal activities.	If three consecutive monthly exceedances are observed breaching the "trigger" level, De Grey will carry out all actions listed under an "early response" exceedance, plus one or more of the following actions as appropriate: • Implement additional MAR. • Increase monitoring frequency. • Consider altering dewatering regimes. • Develop and calibrate a transient numerical model. If findings from the above actions indicate that successive exceedances will likely occur De Grey will consult with required agencies to ensure the Threshold actions remain appropriate.	• Groundwater level in monitoring bores as per Table 2-3.	• Monthly	• Annual Environmental Reports. • Direct report to relevant agencies if required for successive exceedances.
Threshold Criteria				
Groundwater levels at bores identified in Table 2-3 fall below threshold criteria (2 m less than natural variation observed) as a result of Proposal activities.	If three consecutive monthly exceedances are observed breaching the "threshold" level, De Grey will carry out all actions listed under an "early response" and "trigger" exceedance, plus one or more of the following actions as appropriate: • Review the MAR operating strategy. • Cease dewatering.	• Groundwater level in monitoring bores as per Table 2-3.	• Monthly	• Annual Environmental Reports. • Direct report to relevant agencies if required for successive exceedances.

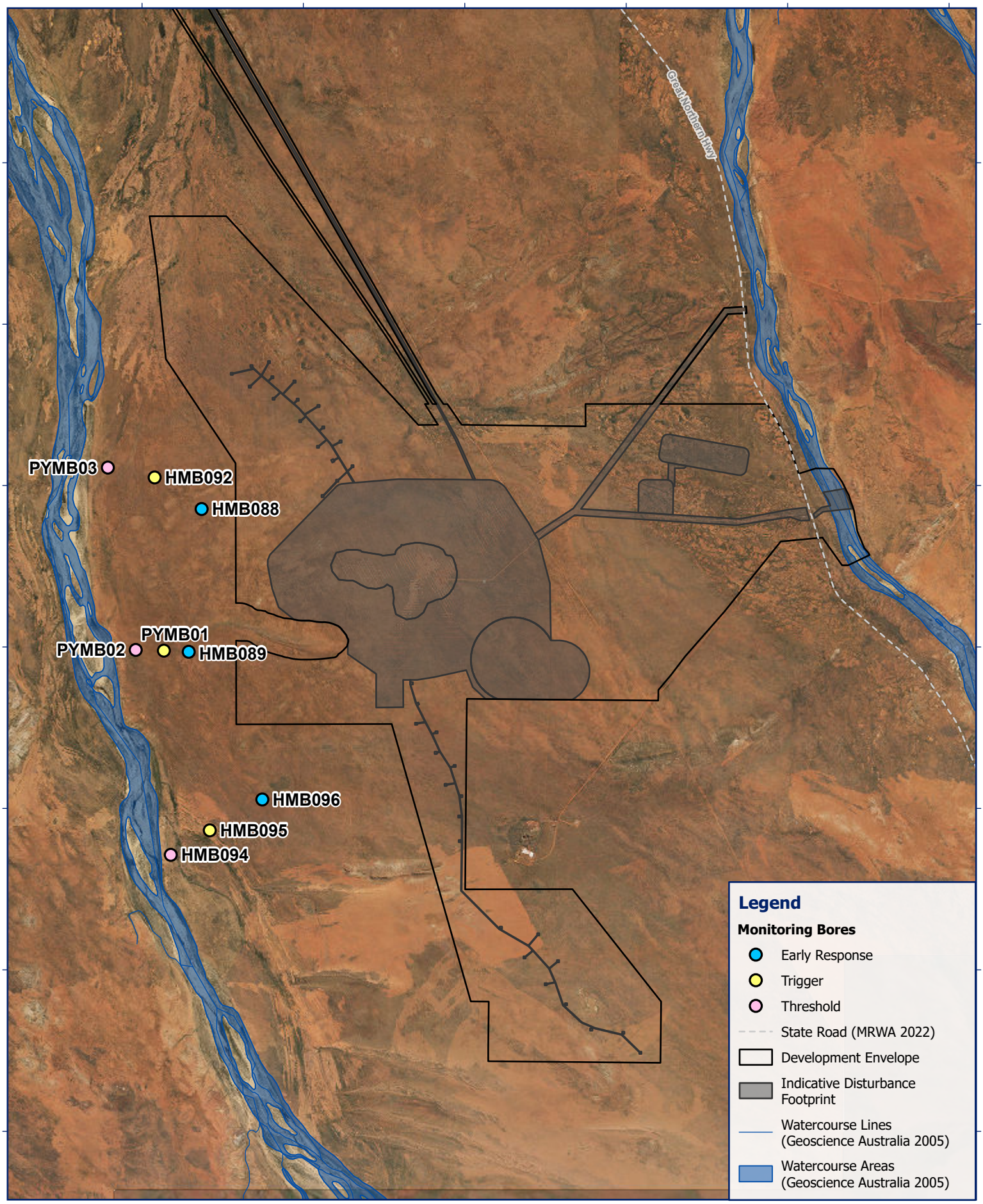
EPA factor/s and objective/s: Inland Waters: 'To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.' **Objective/s:** No significant impact on the Yule and Turner River ecosystems. **Key environmental values:** Potential GDV, aquatic fauna and pools associated with the Yule River.				
Indicators	**Management Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
No indirect impact upon the Turner River due to discharge of Vanadium and Arsenic above Site-Specific Criteria				
Trigger Criteria				
Discharge of surplus water to the Turner River at discharge outlet exceeds Trigger Criteria as per Table 2-4.	Investigate potential cause of exceedance by review of: • Water quality at the settling pond and or outlet/s. • Groundwater monitoring data from production bore/s. • If investigations warrant, increase frequency of monitoring at discharge outlet/s. • If necessary, seek expert advice on the potential risk to the environment and assess bioavailability of toxicants if warranted. • If deemed necessary, instigate field ecological monitoring at potential impact and compare baseline to reference sites, if no observable impact on biota, review site-specific criteria in consultation with stakeholders and experts.	• Water quality at discharge outlet/s	• Monthly	• Annual Environmental Reports. • Direct report to relevant agencies if required for successive exceedances.
Threshold Criteria				
Discharge of surplus water to the Turner River at discharge outlet exceeds Threshold Criteria as per Table 2-4.	Implement previously determined trigger contingency actions, for example: • Investigate probable causes and risk to the environment in consultation with external experts. • If warranted, instigate additional field surveys and/or ecotoxicity studies to determine level of impact on aquatic biota. • Consult with relevant stakeholders. • If impacts on fauna indicate it is necessary, undertake remedial actions as required and permitted on advice from relevant stakeholders. • If field ecological monitoring or ecotoxicity studies indicate exceedance has no acute or chronic effect on biota, revise site-specific criteria in consultation with stakeholders and experts.	• Water quality at discharge outlet	• Monthly	• Annual Environmental Reports. • Direct report to relevant agencies if required for successive exceedances.

Table 2-3: Water Level - Early Response, Trigger and Threshold Criteria for the Yule River

Bore	Easting	Northing	mAHD	mAHD (2 m variation)
Early Response Criteria				
HMB096	643727.908	7685277.93	66.45	64.45
(HMB089	641448.32	7689851.79	59.58	57.58
HMB088	641848.06	7694274.68	53.47	51.47
Trigger Criteria				
HMB095	642100.142	7684322.056	66.71	64.71
PYMB01	640679	7689888	59.25	57.25
HMB092	640392.667	7695252.395	52.35	50.35
Threshold Criteria				
HMB094	640892.619	7683563.333	66.61	64.61
PYMB02	639806	7689910	59.00	57.00
PYMB03	638943	7695558	51.40	49.40

Table 2-4: Water Quality - Early Response, Trigger and Threshold Criteria for Discharge to the Turner River

Analyte (µg/L)	Trigger Criteria (80^{th} Percentile)	Threshold Criteria (95^{th} Percentile)
As	5.7	8.0
V	9.6	11.0



Projection: GDA2020 MGA Zone 50

Scale: 1:150,000

0 1.25 2.5 5 km

N

Created/Reviewed By: KM/EL

Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

RPMGLOBAL

PROJECT

Hemi Gold Project
Environmental Management Plan

Monitoring Bores Location

CLIENT

DE GREY MINING LTD

Figure 2-1	ADV-AU-00673	November 2024

Table 2-5: Outcomes-Based Provisions – Riparian (mature tree) Vegetation

EPA factor/s and objective/s: Flora and vegetation; To protect flora and vegetation so that biological diversity and ecological integrity are maintained. **Outcome-based provision:** Discharge of surplus mine water to the Turner River does not cause significant long-term impact to the Turner River riparian vegetation health. **Key environmental values:** Turner River riparian vegetation – mature trees.				
Indicators	**Response Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Key impacts and risks: Impact on riparian vegetation health due to surplus water discharge				
Early Response Criteria				
Minor health deviation: • 10% decrease in mature tree health in any 1 km linear segment, relative to baseline and comparative to change in reference area.	Early investigation: • Review discharge data (volumes, duration, surface extent). • Review monitoring data – interrogate data further using 1 km zones, risk zones, baseline and reference, attempting to determine reasons for decline. • Continue scheduled monitoring with additional focus on results in areas of decline, and identification of similar results in other areas.	**Parameters:** Canopy cover (sum) and health of mature trees (mean), along 1 km linear segments of the river channel. **Methods:** Multispectral aerial imagery analysis to produce vegetation canopy cover and health metrics. Validation of remote sensing results using a tree health score at field monitoring sites. **Location:** Aerial data will be captured along the full length of maximum discharge extent and upstream of the discharge outfall to provide reference data.	Pre-impact baseline in dry season (September/October), then biannual potential impact monitoring until three years after completion of discharge: • Dry season (September/October). • Post-wet season (April/May) (remote sensing only).	• Annual reporting. • Timely reporting if any threshold criterion is exceeded (notification within 7 days). • Reporting on contingency actions.

EPA factor/s and objective/s: Flora and vegetation; To protect flora and vegetation so that biological diversity and ecological integrity are maintained. **Outcome-based provision:** Discharge of surplus mine water to the Turner River does not cause significant long-term impact to the Turner River riparian vegetation health. **Key environmental values:** Turner River riparian vegetation – mature trees.				
Indicators	**Response Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Trigger Criteria				
Moderate canopy loss: • 15% decrease in canopy cover of mature trees in any 1 km linear segment, relative to baseline and comparative to change in reference area. **OR** Moderate health deviation: • 20% decrease in mature tree health in any 1 km linear segment of the river, relative to baseline and comparative to change in reference area.	In addition to early response actions: • Undertake an investigation into the potential significance of recorded impact at the recorded location for Turner River riparian vegetation. • If areas of decline were not visited during the scheduled field monitoring, then conduct a separate site visit to record field parameters as described in Table 2-6. Compare results to remote sensing and other field monitoring sites to provide further information on potential impacts. • If trigger criteria exceedance is found likely to be due to dewater discharge, modify or cease discharge in consultation with stakeholders. • Review threshold criteria based on results of investigations and in consultation with stakeholders.	**Parameters:** Canopy cover (sum) and health of mature trees (mean), along 1 km linear segments of the river channel. **Methods:** Multispectral aerial imagery analysis to produce vegetation canopy cover and health metrics. Validation of remote sensing results using a tree health score at field monitoring sites. **Location:** Aerial data will be captured along the full length of maximum discharge extent and upstream of the discharge outfall to provide reference data.	Pre-impact baseline in dry season (September/October), then biannual potential impact monitoring until three years after completion of discharge: • Dry season (September/October). • Post-wet season (April/May) (remote sensing only).	• Annual reporting. • Timely reporting if any threshold criterion is exceeded (notification within 7 days). • Reporting on contingency actions.

EPA factor/s and objective/s: Flora and vegetation; To protect flora and vegetation so that biological diversity and ecological integrity are maintained. **Outcome-based provision:** Discharge of surplus mine water to the Turner River does not cause significant long-term impact to the Turner River riparian vegetation health. **Key environmental values:** Turner River riparian vegetation – mature trees.				
Indicators	**Response Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Threshold Criteria				
Severe canopy loss: • >25% decrease in canopy cover of mature trees across any 10% of the river channel within the furthest extent the discharge has reached downstream of the outfall, relative to baseline and comparative to change in reference area. **OR** • 40% decrease in canopy cover of mature trees in two or more 1 km segments. **OR** Severe health deviation: • 30% decrease in mature tree health across any 10% of the river channel within the furthest extent the discharge has reached downstream of the outfall, relative to baseline and comparative to change in reference area.	In addition to early response and trigger actions: • Report to EPA. • If threshold criteria exceedance is found likely to be due to dewater discharge, then modify or cease discharge.	**Parameters:** Canopy cover (sum) and health of mature trees (mean), along 1 km linear segments of the river channel. **Methods:** Multispectral aerial imagery analysis to produce vegetation canopy cover and health metrics. Validation of remote sensing results using a tree health score at field monitoring sites. **Location:** Aerial data will be captured along the full length of maximum discharge extent and upstream of the discharge outfall to provide reference data.	Pre-impact baseline in dry season (September/October), then biannual potential impact monitoring until three years after completion of discharge: • Dry season (September/October). • Post-wet season (April/May) (remote sensing only).	• Annual reporting. • Timely reporting if any threshold criterion is exceeded (notification within 7 days). • Reporting on contingency actions.

Table 2-6: Outcomes-Based Provisions – Riparian (understorey) Vegetation

EPA factor/s and objective/s: Flora and vegetation; To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Key environmental values: Turner River riparian vegetation.
Key impacts and risks: Impact on riparian vegetation health due to surplus water discharge.
Outcome-based provision: The discharge of surplus mine dewater from Hemi Gold Mine to the Turner River does not cause a significant long-term impact on Turner River riparian (understory) health.

Indicators	Response Actions	Monitoring	Timing / Frequency of Actions	Reporting
Early Response Criteria				
Minor health deviation: • 10% decrease in understorey vegetation health (remote sensing) in a 1 km linear segment, relative to baseline and comparative to change in reference area.	Early investigation: • Review discharge data (volumes, duration, surface extent). • Review monitoring data – interrogate data further using 1 km zones, risk zones, baseline and reference, attempting to determine reasons for decline. • Continue scheduled monitoring with additional focus on results in areas of decline, and identification of similar results in other areas.	**Parameters:** • Health (mean) and canopy cover (sum) of understorey vegetation (remote sensing) along 1 km segments of the river channel. • Species presence and foliar cover (%) (field). • Weed species and cover (%) (field). • Vegetation condition (field). • Erosion presence and extent (field). • Feral herbivore presence (field). **Methods:** Multispectral aerial imagery analysis to produce understorey vegetation canopy cover and health metrics. Field monitoring transects. **Location:** Field monitoring sites will be selected in locations with high environmental sensitivity such as those including Priority flora, permanent pools, or those likely to be at higher risk of impact such as areas closer to the discharge outfall. Reference sites will be selected upstream of the discharge outfall.	Pre-impact baseline in the dry season (September/October). Annual potential impact remote sensing monitoring: • Dry season (September/October). • Post-wet season (April/May). • Annual potential impact field monitoring in the dry season (September/October). During project dewatering discharge activity, and for 3 years after completion of discharge.	• Annual reporting. • Timely reporting if any threshold criterion is exceeded (notification within 7 days). • Reporting on contingency actions.

EPA factor/s and objective/s: Flora and vegetation; To protect flora and vegetation so that biological diversity and ecological integrity are maintained. **Key environmental values:** Turner River riparian vegetation. **Key impacts and risks:** Impact on riparian vegetation health due to surplus water discharge. **Outcome-based provision:** The discharge of surplus mine dewater from Hemi Gold Mine to the Turner River does not cause a significant long-term impact on Turner River riparian (understory) health.				
Indicators	**Response Actions**	**Monitoring**	**Timing / Frequency of Actions**	**Reporting**
Trigger Criteria				
Moderate canopy loss: • 20% decrease in canopy cover of understorey vegetation in a 1 km linear segment, relative to baseline and comparative to change in reference area. **OR** Moderate health deviation: • 20% decrease in understorey vegetation health in a 1 km linear segment, relative to baseline and comparative to change in reference area.	In addition to early response actions: • Undertake an investigation into the potential significance of recorded impact at the recorded location for Turner River riparian vegetation. • If areas of decline were not visited during the scheduled field monitoring, then conduct a separate site visit to record field parameters. Results will be compared to remote sensing and other field monitoring sites to provide further information on potential impacts. • Review threshold criteria based on results of investigations and in consultation with stakeholders. • If trigger criteria exceedance is found likely to be due to dewater discharge, modify or cease discharge in consultation with stakeholders.	**Parameters:** • Health (mean) and canopy cover (sum) of understorey vegetation (remote sensing) along 1 km segments of the river channel. • Species presence and foliar cover (%) (field). • Weed species and cover (%) (field). • Vegetation condition (field). • Erosion presence and extent (field). • Feral herbivore presence (field). **Methods:** Multispectral aerial imagery analysis to produce understorey vegetation canopy cover and health metrics. Field monitoring transects. **Location:** Field monitoring sites will be selected in locations with high environmental sensitivity such as those including Priority flora, permanent pools, or those likely to be at higher risk of impact such as areas closer to the discharge outfall. Reference sites will be selected upstream of the discharge outfall.	Pre-impact baseline in the dry season (September/October). Annual potential impact remote sensing monitoring: • Dry season (September/October). • Post-wet season (April/May). • Annual potential impact field monitoring in the dry season (September/October). During project dewatering discharge activity, and for 3 years after completion of discharge.	• Annual reporting. • Timely reporting if any threshold criterion is exceeded (notification within 7 days). • Reporting on contingency actions.

EPA factor/s and objective/s: Flora and vegetation; To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Key environmental values: Turner River riparian vegetation.
Key impacts and risks: Impact on riparian vegetation health due to surplus water discharge.
Outcome-based provision: The discharge of surplus mine dewater from Hemi Gold Mine to the Turner River does not cause a significant long-term impact on Turner River riparian (understory) health.

Indicators	Response Actions	Monitoring	Timing / Frequency of Actions	Reporting
Threshold Criteria				
Severe canopy loss: • >25% decrease in understorey canopy cover across any 10% of the river channel within the furthest extent the discharge has reached downstream of the outfall, relative to baseline and comparative to change in reference area. **OR** • 40% decrease in understorey canopy cover in two or more 1 km segments. Severe health deviation: • 30% decrease in understorey vegetation health across any 10% of the river channel within the furthest extent the discharge has reached downstream of the outfall, relative to baseline and comparative to change in reference area.	In addition to early response and trigger actions: • Report to EPA. • If threshold criteria exceedance is found likely to be due to dewater discharge, then modify or cease discharge.	**Parameters:** • Health (mean) and canopy cover (sum) of understorey vegetation (remote sensing) along 1 km segments of the river channel. • Species presence and foliar cover (%) (field). • Weed species and cover (%) (field). • Vegetation condition (field). • Erosion presence and extent (field). • Feral herbivore presence (field). **Methods:** Multispectral aerial imagery analysis to produce understorey vegetation canopy cover and health metrics. Field monitoring transects. **Location:** Field monitoring sites will be selected in locations with high environmental sensitivity such as those including Priority flora, permanent pools, or those likely to be at higher risk of impact such as areas closer to the discharge outfall. Reference sites will be selected upstream of the discharge outfall.	Pre-impact baseline in the dry season (September/October). Annual potential impact remote sensing monitoring: • Dry season (September/October). • Post-wet season (April/May). • Annual potential impact field monitoring in the dry season (September/October). During project dewatering discharge activity, and for 3 years after completion of discharge.	• Annual reporting. • Timely reporting if any threshold criterion is exceeded (notification within 7 days). • Reporting on contingency actions.

3. MANAGEMENT FRAMEWORK

De Grey is committed to operating the Hemi Gold Project in a sustainable manner that prioritises the health and safety of the workforce, the well-being of surrounding communities, and the protection of the environment. De Grey is dedicated to minimising adverse impacts and strives to achieve industry-leading sustainability standards.

The responsibilities as stated within De Grey's Environmental, Social and Governance (ESG) Policy, are:

- Environmental:
  - Strive for continual improvement in our environmental performance by obtaining and following the best available advice.
  - Monitor and measure our environmental performance and implement measures wherever reasonably practicable to reduce the impact our operations have on the environment.
  - Take all reasonably practicable steps to minimise our impact on the environment and remediate any effects in accordance with best practice.
- Social:
  - Respect the rights, interests, customs, culture and values of all those with whom we interact.
  - Proactively engage with impacted communities, and make every endeavour to obtain free, prior and informed consent for activities that we undertake.
  - Seek to demonstrate, in word and deed, a net positive impact resulting from our operations.
- Governance:
  - Guided by the principles set out by respected institutions such as the Australian Stock Exchange, and the International Council of Mining and Metals.
  - Committed to meeting the highest standards of ethical business practice.
  - Integrating sustainable development in our corporate strategy and decision-making procedures.

De Grey maintains an Environmental Management System (EMS), aligned with ISO 14001, that outlines specific policies and procedures for its operations. Besides that, De Grey will develop and implement project-specific EMS policies, procedures and guidelines as needed, ensuring alignment with the ESG Policy responsibilities and this EMP.

3.1 Reporting

The annual environmental reporting to DWER will report on environmental compliance and management practices. It will encompass the following, building upon the information outlined previously:

- A dedicated section detailing all reported environmental incidents applicable to this EMP during the year.
- For each incident, the report will include:
  - Date and time of the incident;
  - Description of the incident and its potential causes;

- Actions to address the incident, including containment, remediation, and mitigation measures; and
- Lessons learned from the incident and any changes implemented in management practices to prevent future occurrences.

In addition to the regular reporting procedures outlined above, De Grey will report incidents associated with this CSSMP within seven business days to the appropriate regulatory authorities that may be involved (i.e. DCCEEW, DBCA, DWER). Examples of incidents are the discovery of injured or deceased conservation significant species. De Grey will follow established protocols for handling and transporting injured fauna and adhere to the Authority's guidance regarding deceased specimens.

3.2 Roles and responsibilities

Management at all levels and supervisory personnel are to lead by example and set the highest standards for environmental management. They are to act immediately to correct any non-conforming conditions or behaviours and promote environmental awareness at every opportunity. The roles and responsibilities of site personnel can be found in Table 3-1. Importantly, all personnel within the De Grey organisation chart have the authority to stop work if they observe a situation that poses a potential environmental threat. This ensures a proactive approach to environmental protection and empowers everyone to address potential issues immediately.

Table 3-1: Roles and Responsibilities

Role	Responsibilities
Managing Director / Board	• Maintain governance and oversight of De Grey's Sustainability performance through the Board Sustainability Committee. • Endorse the De Grey Environmental Social and Governance Policy or its equivalent.
Project Director and General Manager Operations	• Overall responsibility for the implementation of this Plan. • Ensure resources are available to manage environmental risks present during the construction phase of the Project. • Support and facilitate the communication to De Grey personnel and contractors, regarding the need to comply with this plan. • Report regularly on performance against the plan.
Chief Sustainability & Risk Officer	• Chair the internal Sustainability Working Group. • Approve and support the communication of this Plan to all Managers for implementation throughout the construction and operation phases of the Project. • Ensure adequate resources are available to facilitate and assess compliance with this Plan. • Communicate relevant aspects of this plan to the Executive Leadership Team.
Construction Managers /Field Services Manager	• Facilitate implementation and compliance with this Plan. • Ensure personnel and contractors are familiar with their requirements and responsibilities outlined in this Plan. • Where necessary, coordinate and/or assist in the response to environmental incidents. • Ensure relevant licences, permits or approvals have been obtained prior to activities being undertaken. • Ensure adequate training and resourcing is available to support this Plan. • Ensure environmental data is available from contractors in a timely manner. • Assist with communicating the outcomes of inspections and audits relating to relevant contractor areas and activities undertaken in relation to this plan. • Liaise with the environment team on improvement opportunities relating to contractor activities.
Environment Superintendent	• The plan should be audited to ensure risks are being managed accordingly.

Role	Responsibilities
	• Facilitate continuous improvement to this Plan through the development, implementation and review of supporting environmental management system documentation. • Communicate compliance outcomes to the wider De Grey business. • Ensure annual review of this Plan is undertaken in line with Section 4 of this plan. • Provide technical advice to the business regarding environmental management outcomes. • Ensure external notification of incidents is actioned in line with the Incident Reporting and Investigation standards and procedures.
All Site Superintendents	• To facilitate implementation and compliance with this Plan. • Ensure personnel and contractors are familiar with their requirements and responsibilities outlined in this Plan. • Where necessary, coordinate and/or assist in the response to environmental incidents. • Ensure environmental data is available from the construction team and operation team. • Assist with communicating the outcomes of inspections and audits of contractors' areas, and activities undertaken with this plan. • Liaise with the Environment team on improvement opportunities relating to all associated activities.
Senior Field Services Personnel	• Provide guidance to De Grey personnel and contractors regarding environmental expectations in line with this Plan. • Provide adequate supervision to De Grey personnel and contractors to ensure compliance with this Plan. • Ensure adequate resources are readily accessible in the event of an environmental incident. • Communicate any non-compliance to this Plan. • Where necessary, coordinate and/or assist in the response to environmental incidents. • Undertake data collection for regulatory reporting purposes.
Senior Environment Advisor	• Provide technical advice and guidance to De Grey personnel in relation to this Plan. • Ensure adequate monitoring and measurement is undertaken in relation to this Plan. • Communicate environmental requirements relating to incidents and non-conformances internally and externally, as required. • Investigate environmental improvement opportunities to deliver continuous improvement and integrate outcomes into the environmental management system.
Environment Advisor	• Support the construction and operation team in the implementation of this Plan. • Undertake monitoring and measurement in accordance with this Plan. • Review environmental incidents, hazards, and non-conformances, ensuring adequate corrective and preventative actions have been assigned. • Identify opportunities for improvement in relation to environmental management.
All personnel and contractors	• Familiarise themselves with the requirements of this Plan. • Comply with all De Grey systems and processes, including the requirements of this Plan. • Communicate the requirements of this Plan to any sub-contractors. • Comply with relevant legislation as well as industry guidelines, and standards. • Ensure all incidents are reported and communicated in line with the Incident Reporting and Investigation standards and procedures.

3.3 Training Awareness

De Grey's corporate induction includes environmental information relevant to all De Grey personnel and contractors. Information that is specific to business units, physical locations and individual activities is included within the specific location, work area or task inductions. This information aligns with the key aspects and impacts and communicates the expectations and responsibilities for personnel in relation to environmental management principles.

Regular and ongoing training and awareness packages are presented to personnel in the form of toolbox presentations, environmental bulletins, pre-shift notices and posters displayed in relevant locations. In addition to internal awareness programs, external environmental training is delivered /available as required for specific tasks or individual roles within the organisation.

Records of all training conducted on-site will be maintained, including:

- The person/persons receiving the training.
- The date the training was received.
- The names of the people conducting the training and their respective roles.
- A brief description of the training.

This Plan aims to ensure all people involved with the Project will receive relevant environmental training to understand their responsibilities when implementing the environmental management plan. People to be trained include those at the site/s for all project activities and operations, including contractors, subcontractors, and visitors.

3.4 Emergency Contacts and Procedures

All environment-related events, incidents and hazards must be reported and managed in line with the Incident Reporting & Investigation Standard (DEG-HS-ST-0011), the Incident Investigation Procedure (DEG-HS-PR-0017) and the Environment Incident Severity Matrix. This ensures suitable information is captured to understand the event, including images and statements where necessary, the identification of the root and/or underlying causes, and the assignment of corrective and preventative controls to prevent recurrence.

Where events are required to be reported to external parties, including regulators, the Senior Environment Advisor or Environment Superintendent will liaise with the appropriate stakeholders to ensure adequate information is provided to stakeholders promptly.

The Emergency Preparedness and Response Procedure (DEG-HS-PR-0010) includes environmental emergency information. This procedure describes the mandatory requirements to prepare for, respond to and recover from emergencies. Emergency scenarios and training are developed to include environmental aspects to ensure preparedness for events resulting in an environmental emergency.

4. ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP

Adaptive management is a continuous cycle of monitoring, evaluating, and adjusting management practices to improve environmental outcomes and objectives based on new information and changing circumstances. This may include:

- Monitoring and Evaluation: monitor the effectiveness of the implemented management measures through ongoing monitoring programs. Monitoring data (targeted surveys, inspections, etc.) will be compared to established baseline criteria.
- Triennial Review: review the EMP every three years, by a suitably qualified and experienced person, considering monitoring data and its implications for achieving environmental objectives, the effectiveness of management actions and targets in mitigating environmental impacts, and the relevance of threshold criteria in light of new information or changes in environmental conditions.

In addition to the triennial review, the EMP will be reviewed if any of the following occur:

- New information becomes available, such as changes in the conservation status of managed species, unexpected monitoring results or non-achievement of management targets, and advancements in environmental management practices or technologies.
- Significant changes to the Project, such as an increase in the disturbance area.
- Incidents or audits that identify non-conformances with the EMP.
- Changes in relevant legislation or policies.

Based on the review findings, existing management actions may be adjusted or enhanced to improve their effectiveness or new management actions may be implemented to address unforeseen impacts or emerging issues. Moreover, monitoring programs may be modified to better reflect environmental changes or gather more targeted data.

Any significant changes to the EMP will be documented and communicated to relevant stakeholders, including regulatory authorities. Depending on the nature of the changes, approval from the authorities might be required.

5. STAKEHOLDER CONSULTATION

Effective stakeholder consultation is crucial for a successful and sustainable mining operation. De Grey is committed to open and transparent communication with stakeholders throughout the Project's life. This section outlines De Grey's approach to stakeholder engagement for developing and implementing this EMP. De Grey encourages stakeholders to provide feedback on the mine's operations and the EMP to raise concerns and submit grievances.

Early engagement has allowed De Grey to understand better the community in which the Project is located, as well as identify the key stakeholders that will be impacted by or impact the Project. A broad range of stakeholders with potential interests in the project include:

- Regulatory Authorities: Relevant government agencies overseeing environmental protection and mining operations.
- Investors and Financiers: De Grey is listed under the Australian Securities Exchange.
- Local Communities: Residents and community groups residing near the mine.
- Government: State and local governments who are set to benefit financially from the operation of the mine.
- Traditional Owners: Indigenous groups with traditional connections to the land.
- Non-Governmental Organisations (NGOs): Environmental and social advocacy groups.
- Industry Associations: Mining industry representatives and organisations.

The primary objectives for stakeholder consultation are:

- To inform stakeholders about the mine's operations, potential environmental impacts, and the proposed mitigation measures outlined in this EMP.
- To understand stakeholder concerns regarding the environmental impacts of the mine and incorporate their feedback into the EMP, where practicable.
- To foster collaboration and build positive relationships with stakeholders to ensure the long-term success of the mine and its environmental management practices.

De Grey has employed and will employ various methods to engage with stakeholders throughout the mine's life. These methods may include community meetings, participation in committees, written communications, publishing relevant information on the website and via social media, and maintaining access to a suitable feedback and complaint mechanism.

De Grey is committed to, reviewing the effectiveness of our stakeholder consultation practices, and making adjustments to ensure meaningful ongoing stakeholder engagement during all phases of operation.

6. TERMS & DEFINITIONS

The various terms and definitions that are shown in this document are listed below.

Term	Definition
BC Act	*Biodiversity Conservation Act 2016*
CSSMP	Conservation Significant Species Management Plan
EMP	Environmental Management Plan
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EMS	Environmental Management System
GDV	Groundwater Dependent Vegetation
IWL	Integrated Waste Landform
KAC	Kariyarra Aboriginal Corporation
MAR	Managed Aquifer Recharge
MNES	Matters of National Environmental Significance
MRF	Mine Rehabilitation Fund
Mining Act	*Mining Act 1972*
NGOs	Non-Governmental Organizations
PEC	Priority Ecological Community
PEOF	Pilbara Environmental Offset Fund
SPRAT	Species Profile and Threats Database
TSF	Tailings Storage Facility
WRLs	Waste Rock Landforms
WWTP	Wastewater Treatment Plant

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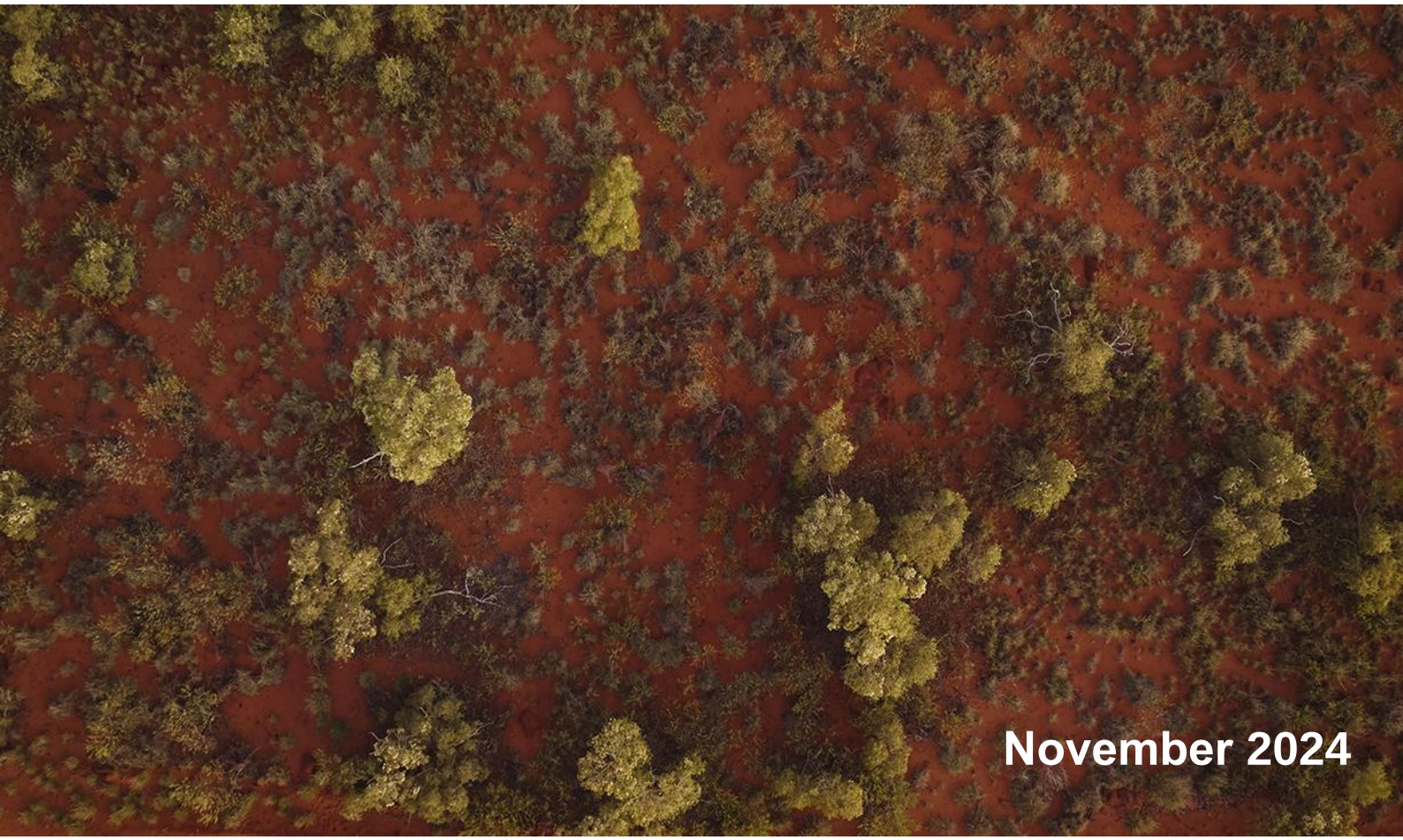
APPENDICES

APPENDIX 1: GREATER BILBY PROTOCOL (DEG-EN-RP-0003)

DE GREY MINING LTD

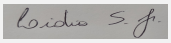
GREATER BILBY DISTURBANCE PROTOCOLS

HEMI GOLD PROJECT



November 2024

AUTHORISATIONS

Task	Name	Company	Signature	Date
Prepared By	Lidio Junior	RPM Advisory Services Pty Ltd		17.07.2024
	Jonathon Barker	De Grey Mining Limited		17.07.2024
Reviewed By	Sarah Thomas	De Grey Mining Limited		22.07.2024
Approved By	Glenn Jardine	De Grey Mining Limited		30.07.2024

Prepared by

Prepared for

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APPENDICES

1. INTRODUCTION

1.1 The Proposal

De Grey Mining Limited (De Grey) is seeking approval to develop the Hemi Gold Project (Hemi or the Project), a greenfield gold mine located in the Pilbara region of Western Australia. The project footprint includes potential critical habitat for the Greater Bilby (*Macrotis lagotis*), a mammal listed as 'Vulnerable' under Western Australia Biodiversity Conservation Act 2016 (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Project's key components involve open-cut mining of gold ore from six deposits (Aquila, Brolga, Crow, Diucon, Eagle, and Falcon), ore processing on-site, an Integrated Waste Landform (IWL) Tailings Storage Facility (TSF) and ancillary activities to support mining.

De Grey has developed an Environmental Management Plan (EMP) (De Grey, 2024) for the Proposal to outline how it will manage impacts on environmental factors identified under the *Environmental Protection Act 1986* (EP Act) and the EPBC Act. This includes protecting Matters of National Environmental Significance (MNES), such as the Greater Bilby. The EMP details specific mitigation and management measures aimed at reducing potential impacts on environmental factors and MNES species that could be significantly affected by the proposed activities.

The protocols detailed below are a how-to guide that will minimise the impacts of the Proposed Actions on the Greater Bilby, complementing the strategic measures in the EMP.

1.2 Purpose

This report details the protocols that will be implemented at the Hemi Gold Project to protect the Greater Bilby during native vegetation clearing activities. The protocols align with the Department of Biodiversity, Conservation, and Attractions (DBCA) Guidelines (DBCA, 2018) for pre-clearing searches to locate resident Greater Bilbies and for relocation of Greater Bilbies prior to vegetation clearing.

Implementing these protocols aims to avoid or minimise the direct and indirect impacts of the Proposed Action on the Greater Bilby populations within the Development Envelope. De Grey will ensure any Greater Bilbies utilising the area are identified and relocated outside of the impact area before clearing occurs.

1.3 Personnel Experience and Qualifications

Several of the following Greater Bilby management protocols require a Fauna Handler/Spotter with relevant experience and training. The requirements include:

- The ability to reliably observe and identify Greater Bilby signs (scats, tracks, burrows and diggings);
- Completion of training in fauna capture, handling, and care techniques that meet DBCA standards.

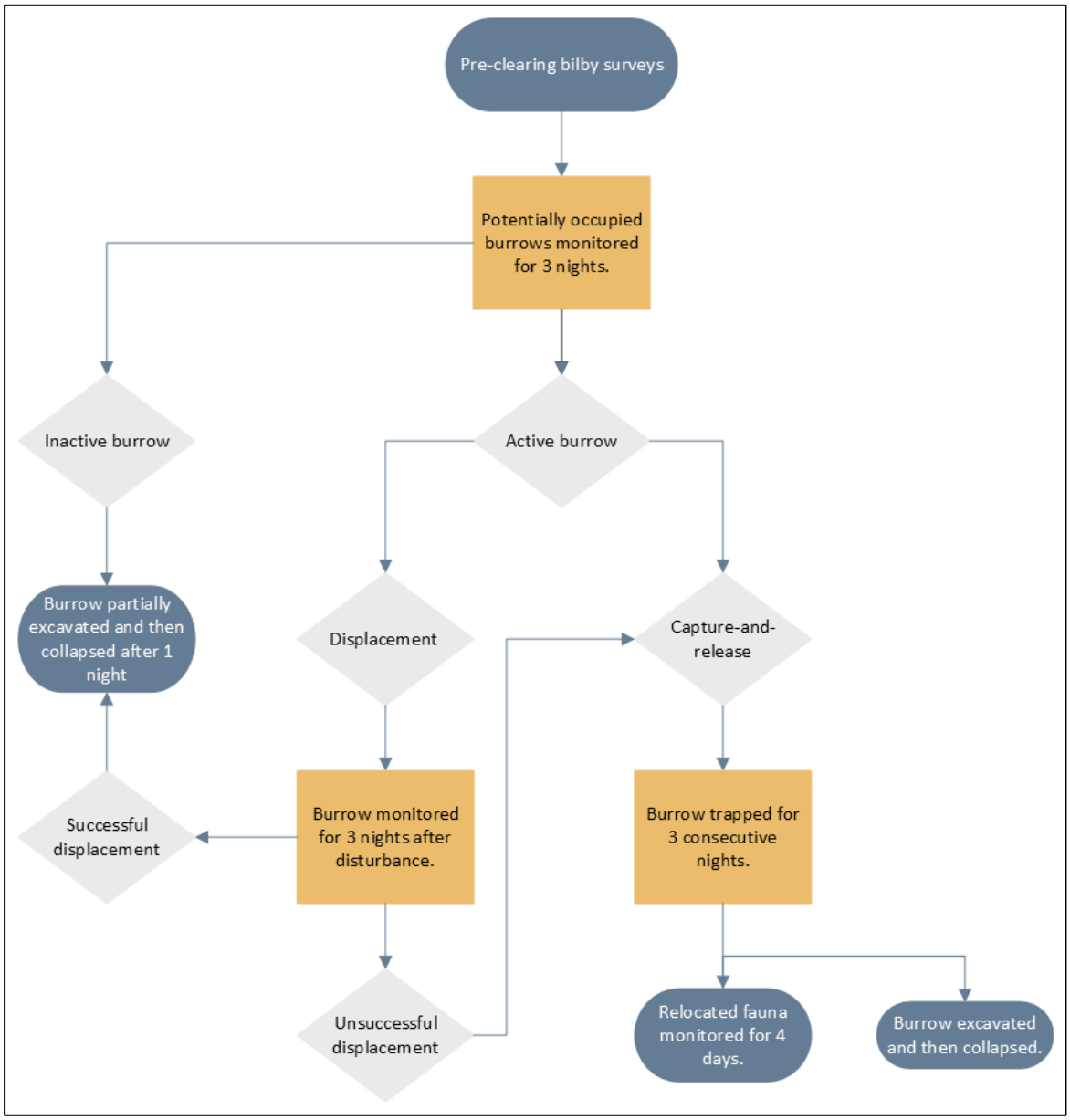
- Possession of a fauna-taking (relocation) licence under the Biodiversity Conservation Regulations 2018. Licensees may be assisted by other individuals under a single licence if they are acting under the direct supervision of the licence holder.
- Completion of training in fauna euthanasia techniques that meet DBCA standards, although euthanasia will be only considered as a last resort.
- Meeting De Grey's job training and certification requirements.

2. GREATER BILBY MANAGEMENT PROTOCOLS

The following protocols will be implemented:

- Pre-clearing Greater Bilby surveys;
- Camera monitoring;
- Collapsing of inactive burrows;
- Active burrow displacement, and/or capture-and-release; and
- Vegetation clearing with a fauna spotter.

Figure 2-1 Flowchart for operational guidance



2.1 Pre-clearing Surveys

Pre-clearing surveys are a critical step in minimising impacts on Greater Bilbies by identifying their presence within the Development Envelope before clearing activities commence. Clearance surveys must be conducted in accordance with the conditions of the development or clearing approval, the approved Environmental Management Plan, and the license to relocate fauna. Additional licenses or permits may be required.

Pre-clearing Greater Bilby surveys must be undertaken two weeks before land clearing within Greater Bilby critical habitat (most of the Development Envelope has been identified as critical habitat). During pre-clearance surveys, areas to be cleared must be visually marked to ensure that clearing only occurs within approved areas.

Pre-clearing surveys will look for signs (scats, tracks, burrows, and diggings) to efficiently and reliably detect whether Greater Bilbies are present. Surveys will be conducted as close as possible to the time of clearing.

Although not the specific focus of the pre-clearance survey, the presence of any conservation significant species, including the Night Parrot, will trigger a stop work order. The Environment Team are to be notified immediately, and an assessment of the situation and next steps will be undertaken in consultation with relevant regulatory authorities (e.g., DBCA).

Linear surveys will be conducted in the area set to be cleared or disturbed, employing graduated levels of intensity. Fauna handlers/spotters will traverse transects, spaced close enough to ensure signs of Greater Bilby between transects will not be missed. Initial transects are to be spaced at a maximum of 200 m apart. The spacing of these transects will be variable depending on the terrain and density of vegetation, with more densely vegetated areas requiring closer transects.

If evidence of Greater Bilby is found during these initial transects, more intensive searches must be undertaken in that area, with even smaller transect spacing, to locate all occupied burrows. These transects are to be approximately 20 m apart.

All signs of Greater Bilby found during surveys will be recorded. The presence of Greater Bilby will be validated using signs including scats, clear fresh tracks, diggings, and images captured using remotely deployed cameras.

2.1.1 Identification of Greater Bilby Burrows and Diggings

Greater Bilbies occasionally use holes under termite mounds and other burrows that do not have a distinctive sand apron at the entrance. Other species are known to refurbish and use old Greater Bilby burrows. Burrows are a sign of potential Greater Bilby activity, however they cannot solely confirm the presence of Greater Bilbies.

Greater Bilbies construct burrows up to 4.5 m long and 2 m deep. Burrows may spiral downwards, have side branches, and tunnels may be blocked by fresh soil. Burrow entrances are round or arch-shaped. Most Greater Bilby burrows have a single entrance, but 'warrens' with multiple entrances can occur. An apron of excavated sand is usually present outside the entrance.

A burrow may only be considered unoccupied if it fulfils two conditions:

- It has begun to collapse and no longer has an entrance that would enable a Greater Bilby to enter without additional digging; and
- There is no evidence that other vertebrates are making use of the burrow; and/or it has vegetation and cobwebs across the entrance.

Scratchings and diggings vary in size, ranging up to 10 cm deep. Soil from diggings is usually scattered around the hole rather than deposited in a discrete pile. Soil type affects the size and shape of diggings, typically smaller in firm soils. The Greater Bilby often make near-circular diggings around 200mm in diameter, ranging from 200mm to 400mm in depth.

The only diggings uniquely attributed to the Greater Bilby are at the base of shrubs or forbs for root-dwelling larvae. Therefore, only these diggings can be used to confirm the presence of Greater Bilby. Most of the shrubs or forbs that contain root-dwelling larvae used by Greater Bilby are *Acacia* species.

2.1.2 Identification of Greater Bilby Tracks

Where possible, searches for tracks should be undertaken in the morning or late afternoon when shadowing is optimal. Tracks are most easily detected in fine, lightly compacted sand, and sometimes following rainfall. It is important to estimate the age of tracks in relation to more recent signs, rain or strong wind events, or a prepared swept surface.

Greater Bilby tracks are characterised by:

- Staggered front imprints, and hind imprints that are mostly parallel. This is because the hind limbs generally move together, while the forelimbs move one at a time.
- Hind track imprints that are narrow and longer than the front. The hind print is produced primarily by the fourth toe, with little noticeable indentation produced by the fifth toe.
- Toes and claws on the front foot producing three parallel print marks of similar length.

Three distinct parallel marks representing toes on the front foot, and slender hind foot marks without a distinct protruding side toe imprint are necessary to confirm Greater Bilby presence.

The length and breadth of a set of tracks can be used to gauge an individual's size. This can help surveyors ascertain whether multiple individuals are at a site.

Experienced fauna handlers/spotters can utilise the above characteristics to distinguish Greater Bilby tracks from those of other animals.

2.1.3 Identification of Greater Bilby Scats

Greater Bilby scats are often found on top of or within the sand-spoil of diggings. Typically, a group of two to five pellets is deposited, with a smooth coating and rounded ends. Scats are oblong-shaped, round in cross-section, and firm, usually containing a mixture of sand, plant, and invertebrate material. Greater Bilby scats can persist for several months. Scat size (specifically diameter), can be used to identify the presence of juveniles.

2.2 Camera Monitoring

Burrows within the proposed clearing area that are potentially active will require monitoring. Therefore, the following will be used as the trigger for camera monitoring:

- The burrow is open, with or without a sand apron, and
- Fresh signs of Greater Bilby are present at the site.

Remote cameras will be placed at all burrow entrances. Ensure the camera type, settings, and positioning are selected to increase the likelihood of fauna triggering them. If there is no evidence of fauna activity for at least three nights, then the burrow can be classified as inactive and collapsed (see Section 2.3). Following monitoring, if a burrow is occupied or potentially occupied/unknown, two approaches can be used to relocate Greater Bilbies: displacement or capture and release (see Section 2.4 and/or 2.5).

2.3 Collapsing of Inactive Burrows

Inactive burrows should be exposed by digging them out to 1 m with a shovel for one night, making them unsuitable for use by vertebrates and enabling any remaining fauna to escape. They should then be filled in. The location of collapsed burrows should be recorded, and during vegetation clearing, these sites must be inspected to ensure they have not been re-excavated or re-occupied.

2.3.1 Burrow Excavation Protocol

There are no formal guidelines or DBCA Standard Operating Procedure (SOP) for collapsing burrows. Therefore, this Protocol has been developed by drawing on established best practices and scientific knowledge.

Two personnel must always be present when burrow collapsing is undertaken, with at least one of these individuals to be a qualified fauna handler/spotter.

Health and Safety

All personnel participating must wear and use suitable personal protective equipment. This includes eye protection, gloves, safety boots, long trousers, long-sleeved shirts, and sun protection.

Dangerous fauna must be avoided and should never be handled. Personnel must be removed from the area until dangerous fauna have dispersed. If fauna needs to be captured and relocated, this may only be undertaken by a qualified fauna handler/spotter.

Equipment

Equipment required for burrow excavation includes, but is not limited to:

- Personal protective equipment.
- Two blunt-nosed shovels.
- Garden trowels.
- Torch.
- First aid kit that includes snake bite treatment equipment.
- Fauna capture and fauna first aid kits.
- Data record sheets.

Procedure

Before commencing excavation, carefully inspect the burrow for signs of fauna. Burrows may contain Greater Bilbies, goannas, feral cats, snakes, or other fauna. If fauna is observed, then attempts should be made to remove them before excavation commences.

Place a shovel handle down the burrow entrance as far as possible. Then, slice away the ceiling with the second shovel/trowel, removing the sides and surrounding soils when required. Continue sliding the first shovel down into the burrow chamber so the burrow is not lost during excavation.

Excavate slowly and carefully, stopping often to see if a Greater Bilby is within reach or if the end of the burrow is visible. Do not collapse the burrow ahead of the shovel or trowel inside the burrow.

The fauna species found may be either displaced or captured. Continue excavation until you reach the end of the burrow and all branches and chambers have been inspected.

After excavation, fill in the remaining hole and complete the record sheet for burrow collapsing.

Fauna Capture and Relocation

During burrow collapse, fauna capture, handling and relocation should be conducted according to the protocols outlined in Section 2.5.

All fauna captures need to be humane and ethical. They will be implemented in accordance with industry standards outlined in the DBCA SOP's *Hand Capture of Wildlife* (DBCA, 2023a) (Appendix 1), *Hand Restraint of Wildlife* (DBCA, 2023b) (Appendix 2), and *Transport and Temporary Holding of Wildlife* (DBCA, 2022) (Appendix 3). If ejected pouch young are found, they must be re-inserted, taped, and released together with the parent Greater Bilby, to be completed in accordance with the SOP *Care of Ejected Pouch Young* (DBCA, 2023b) (Appendix 4).

The fauna handler/spotter should handle and assess any fauna captured. Uninjured fauna suitable for immediate release should be released at an appropriate adjacent site by the handler. If injured fauna is discovered and it is unsuitable for immediate release, the DBCA will need to be contacted. Provisions must be made for short-term onsite care or transfer to an offsite rehabilitation centre.

If dead fauna is encountered, records should be made of the location, number of individuals, species, and likely cause of death.

2.4 Active Burrows: Displacement

Displacement is only appropriate when there is a suitable adjacent habitat that meets the following criteria:

- The habitat will remain undisturbed;
- Threats to the Greater Bilby are managed; and
- The habitat will remain viable in the long term.

If there is no suitable adjacent habitat, then capture and release must be used. Capture and release must also be used if the displacement of an occupied burrow is unsuccessful. Displacement is preferred because it is often less stressful and more effective than the capture-and-release approach.

Remote cameras must remain *in situ* to continue monitoring fauna activity and confirm that fauna has left the burrow. Successful displacement must be confirmed with evidence (camera monitoring or other monitoring techniques). Some disturbance (i.e. partial excavation) of burrow entrances will be required to ensure that disturbance does not prevent fauna from leaving the burrow. To confirm that displacement has been successful, time and date-stamped images of fauna exiting a burrow and not returning, along with a lack of fresh Greater Bilby signs, must be gathered. A minimum of two cameras positioned at different angles must be used to monitor each burrow.

Burrows must be filled in immediately once fauna displacement has been confirmed. Excavation must be done by hand. Burrows must continue to be monitored up until clearing is undertaken to ensure that recolonisation does not occur. Monitoring must continue for three nights after disturbance for displacement to be certain.

If displacement is unsuccessful after three nights of monitoring, then capture-and-release of the Greater Bilbies still occupying the burrow will be required.

Following displacement, new burrows may be created in the development footprint. When found, potentially active burrows within the development footprint must have their location recorded and undergo continued camera monitoring. In the week following displacement, fauna handlers/spotters must search the habitat adjacent to the filled-in Greater Bilby burrow for fresh signs and newly occupied burrows to confirm the area that individuals have moved to.

2.5 Active Burrows: Capture and Release

Capture and release should only be used as a last resort after unsuccessful displacement efforts. This section outlines the protocols for humane capture, handling, transport, and release of Greater Bilbies.

Capture and release must only be undertaken by personnel with appropriate skills and experience, as well as the necessary licenses, permits, and approvals. Release sites must be identified and confirmed prior to the commencement of any trapping, and the location, quality of habitat, and occupancy at release sites should be documented. If a suitable burrow cannot be found at the release site, artificial burrows should be constructed before fauna capture commences.

2.5.1 Capture Methods

Yard traps or burrow traps (traps placed in burrow entrances) must be used. Capture methods will be implemented in accordance with industry standards, documented in DBCA SOP *Cage Traps for Live Capture of Terrestrial Vertebrates* (DBCA, 2023) (Appendix 5).

Yard traps should be installed when:

- It is not feasible to fit a trap neatly into a burrow entrance;
- There are multiple entrances;
- There is evidence the burrow may contain multiple individuals; or
- A Greater Bilby has set off a burrow trap but was not captured.

Bait is unnecessary in both burrow and yard traps.

Burrow traps

Cage traps with internal-opening doors (spring-closing) are required. Hessian must cover the top and sides of the trap, but not the end, to enable a Greater Bilby to see out. Hessian must not cover the base of the trap either.

The sides of the burrow must be dug out carefully using a small shovel, allowing the trap to fit comfortably inside. The treadle needs to be just inside the burrow entrance and must remain free and protected from sand build-up. The treadle can be camouflaged by spraying water over it and then sprinkling sand atop it.

Yard traps

A yard must be built around the potentially active burrow using 3 - 4 m panels of square mesh that are at least 25 x 25 mm fine. This yard must be 900 mm tall and have a hinged 300 - 400 mm footing attached with ring fasteners. Panels should encircle the burrow, leaving at least 1 m of space from the entrance. The footing must face inward toward the burrow entrance and can be cut to enable overlap, with panels curving around the burrow. Panels of large radius traps may require support with attachment to external star pickets.

Internally opening (and spring closing) cage traps must be set inside the yard trap, against the side of a panel, with the wire mesh on the base obscured by sand. The top and sides of these traps should be covered with Hessian cloth.

Trapping Period

Traps must be checked at sunrise each morning. Burrow traps sprung by an uncaptured animal need to be replaced with a yard trap around the burrow.

Potentially active burrows should not be trapped for more than three consecutive nights. After three nights, burrows should be excavated (confirming that all animals have been captured) and then collapsed to avoid re-excavation. Collapsed burrows must continue to be monitored until clearing is undertaken.

2.5.2 Handling Protocols

For handling protocols, authorised personnel must act in accordance with DBCA SOP's *Hand Capture of Wildlife* (DBCA, 2023a)(Appendix 1), and *Hand Restraint of Wildlife* (DBCA, 2023c) (Appendix 2) and *Transport and Temporary Holding of Wildlife* (DBCA, 2022) (Appendix 3).

Interactions with animals captured during relocation must be humane and ethical. The animal handler/s must be experienced in working with the Greater Bilby to ensure the relocation program presents limited risk to the animals. The length of time handling animals will be restricted as much as possible.

Upon removing animals from traps, handlers must carefully inspect the trap and its immediate surroundings for ejected pouch young. Any ejected pouch young must be re-inserted, taped, and released together. Young-at-foot spend two weeks in a burrow before being left by the mother to become independent. At this stage, they are unlikely to survive if relocated. If found, young-at-foot must be placed with a pre-determined, licensed wildlife rehabilitator who has experience with

Greater Bilbies, and the DBCA must be notified within 24 hours. Fauna handlers/spotters must refer to DBCA SOP *Care of Ejected Pouch Young* (DBCA, 2023b) (Appendix 4).

If a lactating female is captured, the handler/s must hold the mother until burrow excavation is complete and attempt to retrieve and reunite them with the young.

2.5.3 Transport and release

Animals must be released at the pre-selected release site as soon as possible. If release cannot be undertaken immediately (in the early morning), then the animals must be stored in a dark, well-ventilated, quiet, and cool area (less than 20°C) in a soft containment bag within a pet pack. Animals must not be held for more than 14 hours.

Greater Bilbies will be stored using industry-standard soft containment methods, these are outlined in the DBCA SOP *Animal Handling and Restraint Using Soft Containment* (DBCA, 2022b) (Appendix 6).

The location, quality of habitat, and occupancy of release sites must be documented. The release site should be selected based on several criteria, including:

- Where possible, fauna should be moved at least 5 km away from the capture site.
- Existing evidence of Greater Bilbies.
- Similar habitat type to the capture site.
- Absence of obvious threats (areas within the advancing mine front, predators' presence, competition).
- Availability of food and water resources.

If a suitable burrow cannot be found at the release site, an artificial burrow must be constructed. Artificial burrows will have:

- A slope of 30 degrees;
- A minimum depth of 1m;
- A roof lined with halved PVC pipe (35 – 45 mm in diameter); and
- An earth floor.

It is recommended that multiple burrows be located at or around the release site. Animals are to be released at the entrance to an artificial or natural burrow.

If the Greater Bilbies are released in the early morning, a yard trap must be erected around the intended release burrow. This will contain the Greater Bilbies if they find the burrow unsuitable and decide to re-emerge in daylight. The yard trap can then be removed at dusk.

Monitoring of Relocated Greater Bilbies

Monitoring must be conducted to assess:

- Health of the Greater Bilbies.
- Whether they remain at the release site.
- Whether other individuals are present.

Monitoring burrows for four days using remote cameras is recommended.

2.6 Vegetation Clearing Supervision

If clearing is scheduled to commence and the displacement/relocation of fauna from occupied or potentially occupied burrows cannot be confirmed, clearing should be postponed.

If this is not possible, the burrow must be clearly marked, and clearing should be undertaken from one direction progressively toward the burrow. Before reaching the marked burrow, it must be carefully excavated by hand. This is an absolute last resort and should only be undertaken after all other methods above have been completed for a minimum of a week and clearing cannot be postponed.

A walk-through of the clearing area should be conducted immediately prior to clearing to inspect filled burrows and ensure no fauna has recolonised them, as well as to ensure no new burrows have been constructed. Clearing should commence at a maximum distance from any retained burrow and progressively work towards it and must be conducted in a direction that allows fauna to move into adjacent vegetation that is not proposed to be cleared. A fauna spotter must be present during all clearing activities.

2.7 Monitoring Following Clearing

Remote cameras installed at burrows outside the clearing area, within future disturbance areas, or at release sites must remain *in situ* to monitor fauna movement during displacement and clearing activities.

The cleared area must be inspected periodically to determine if Greater Bilbies have recolonised it. Greater Bilbies often prefer loose, recently excavated soil to construct new burrows, so areas of loose soil and soil piles should be minimised to discourage them.

If more than two weeks pass between clearing stages and other activities commencing (i.e. construction), then additional pre-clearing searches may be required, as fauna could recolonise the site.

3. REPORTING

Registration forms recording each action described in this protocol are provided in Appendix 7.

4. REFERENCES

De Grey. (2024). *Environmental Management Plan - Hemi Gold Project*.

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APPENDICES

Appendix 1: Hand Capture of Wildlife

Standard Operating Procedure

SC22-12 HAND CAPTURE OF WILDLIFE

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes*.

Version 1.2

February 2023

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Revision History Log

Version	Date	Details	Author/Reviewer	Approved By	Approval
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1.2	19/08/2021	Revision of content & clarification of procedures	S. Garretson, J. Renwick and A. Robey	M. Dziminski	February 2023

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Approved by the DBCA Animal Ethics Committee:

Dr Martin Dziminski
Chair, Animal Ethics Committee
Department of Biodiversity, Conservation and Attractions

Contents

1 Acknowledgements

This standard operating procedure was originally developed by Christine Freegard and Vanessa Richter, with contributions from Nicole Godfrey, Teagan Johnston and Colleen Sims.

2 Purpose

Hand capture may be required as part of fauna monitoring and research activities and the removal of nuisance, derelict or displaced fauna. Monitoring methods that involve or require the hand capture of animals include the use of nest boxes and undertaking active searches.

There are numerous methods suitable for capturing wildlife by hand, using hands or the use of tools. All methods of hand capture described in this standard operating procedure require the presence of a person for the capture of the animal.

Hand capture is stressful to animals and steps must be taken to minimise any distress that is caused to the animal and the population from which they are taken. Careful consideration must be given when choosing which hand capture technique to use, and whether or not a trapping technique or other alternative would be more appropriate.

This Standard Operating Procedure (SOP) provides general guidelines for the various types of hand capture of fauna for research purposes to ensure minimal stress and injury to the animals and handlers.

3 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department of Biodiversity, Conservation and Attractions' (DBCA) Animal Ethics Committee (AEC). However, this SOP may also be appropriate for other situations.

This SOP applies to all hand capture of wildlife undertaken across Western Australia by DBCA (hereafter department) personnel. It may also be used to guide fauna related activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All department personnel involved in the hand capture of wildlife should be familiar with the content of this document.

Projects involving wildlife may require a licence/authorisation under the *Biodiversity Conservation Act 2016*. Personnel should consult the department's Wildlife Licensing Section and Animal Ethics Committee Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for all AEC approved projects. A copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

4 Animal Welfare Considerations

To reduce the level of impact of hand capture on the welfare of animals, personnel must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented and contingencies for managing welfare issues have been identified. All handlers and volunteers involved in the project should be aware of the range of issues that they may encounter, the options that are available for reducing impacts and improving animal welfare, and the process for managing adverse events.

Department projects involving hand capture will require approval from the department's AEC. Key animal welfare considerations that should be considered when employing hand capture are listed below and highlighted throughout the document.

4.1 Injury and unexpected deaths

If adverse events including injury, unexpected deaths or unplanned requirement for euthanasia occur then it is essential to consider the possible causes and take action to prevent further issues. Adhering to the guidance in this SOP will assist in minimising the likelihood of adverse events and any unnecessary stress to the animal. For projects approved by the department's AEC, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the department SOP for *Euthanasia of Animals Under Field Conditions*. Where disease may be suspected, refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

4.2 Level of impact

If the animal is captured immediately after it is seen and released within a few minutes (usually no more than five minutes), the impact on the animal is reduced. If the animal needs to be pursued, the effect will be greater.

Potential animal welfare impacts of hand capture include:

- Trauma (e.g. accidental injuries inflicted)
- Stress

It is not always possible to tell if an animal is stressed, and therefore at risk of injury or death. Some signs that they may show they are stressed include:

- Obvious increase in heart rate or breathing rate
- Animal is limp or closes its eyes (mammals)
- Animal may feel hot to the touch
- Eyes open, rigid with fright
- Panting, heat stress
- Licking forearms, shoulders and flanks (Macropods)
- Hypersalivation (drooling, slobbering and frothing in Macropods)
- Shivering
- Vocalising (sounds of pain or aggression)
- Struggling that does not settle down (behaviour such as mouth open, baring teeth, lunging/biting, excessive kicking)

- Throwing pouch young.

Field planning must involve risk mitigation of the above potential impacts to the fullest extent possible. Note that whilst these impacts are specifically associated with hand capture, an animal may also experience other impacts from associated procedures such as handling and transport. Investigators must be aware that the effects of a series of stressors, such as capture, handling, transportation, sedation, anaesthesia and marking can be cumulative.

5 Approved Methods

The hand capture of an animal may require the use of a tool that either aids in the capture of the animal such as a net or tongs, or one that protects the captor or animal from injury, such as protective gloves, hand nets and cover boards.

ANIMAL WELFARE: Incorrect capture techniques can injure or kill animals therefore hand capture is only to be used by competent personnel with recognised appropriate training and/or experience. Capture must be as stress free as possible. If at any stage during hand capture the circumstances increase the potential for human or animal injury to an unacceptable level, the procedure should be stopped.

It is important to plan for hand capture by:

1. Having a thorough knowledge of the possible species being caught (behaviour, reaction to stress, ability to defend itself) and the appropriate hand restraint techniques (see department SOPs for *Hand Restraint of Wildlife* and *Animal Handling and Restraint using Soft Containment*).
2. Having all equipment required for hand capture ready and accessible.
3. Considering the best time of day, year, and weather conditions to undertake the procedure.

The rate of success in hand capture is greatly dependent on the skills of the handler/operator.

ANIMAL WELFARE: Animals should only be handled during capture for as long as it takes to secure them in a holding bag/container to reduce stress. They must be released within 24 hours of capture (unless otherwise approved).

5.1 Capture by hand

Capture by hand involves the capture of individual animals by grasping it with the hands before it is able to escape and is generally only employed when other capture methods are not available. All species can potentially be collected in this manner, but it is most typically applied during the survey of reptiles and amphibians, or for the capture of sick or injured wildlife. The exact technique will depend on the situation and species involved. **The following is general advice only.**

ANIMAL WELFARE: Capture myopathy is a condition which may be seen in many species of mammals and birds. It may be associated with:

- capture and restraint
- transport
- repeated handling

- placing animals in an unfamiliar environment or close confinement
- pursuit

Although it is mostly associated with prolonged muscle exertion, it may also be seen in animals experiencing fear or anxiety without physical exertion, as the physiological changes which occur are caused by prolonged and sustained adrenaline effects on the circulation, as well as muscle damage and lactic acid buildup (Vogelnest and Portas, 2008).

The condition can result in sudden death but death may also occur weeks after capture as a result of complications including organ failure and a loss of mobility which increases susceptibility to predation (Abbot *et al*., 2005).

Affected animals may exhibit panting, increased heart rate, shock, hyperthermia, muscle tremors and spasms, collapse, inability to hold the head up and inability to stand.

Capture myopathy carries a guarded to poor prognosis and management should focus on preventing its occurrence through efforts to minimise stress. Animals should only be handled for as long as required to identify them and to collect any necessary measurements (usually no more than five minutes). At a maximum they must be released (or reach alternate end point) within 24 hours of capture. Every effort should be made to avoid stressful events during hot weather.

Records of animals suspected to be suffering from capture myopathy need to be reported to the department's AEC. Any animal suspected to have died from capture myopathy must be sent for necropsy and a copy of the report provided to the department's AEC with an Adverse Event Form.

(a) When capturing an animal by hand, the grip and force applied must be appropriate for the species in question. The animal may be at risk of suffocation if pressure is too strong, and limbs may be broken with too much force or incorrect holding technique. Too soft a restraint makes the animal think it has a chance to escape, therefore making it struggle more. Where possible, covering the animal's eyes can quickly and effectively reduce stress.

Personnel also need to take care to ensure that they do not injure/kill animals by stepping on them or on objects under which the animal may be hiding (e.g. rocks, etc.).

(b) Prolonged pursuit to capture by hand must not be performed. Personnel must use judgement in deciding when an animal cannot be caught quickly or when it is not safe to do so and abandon the capture. Other ways to capture and safely handle the animal may be more suitable to help prevent injury to the animal and handler.

ANIMAL WELFARE: An experienced and competent operator/team leader must closely monitor the target animal for signs of excessive stress and decide when to abandon a pursuit.

(c) Plan the capture so that the animal is quickly restrained with minimal stress and injury. Most small or docile animals can be managed by one person. Larger animals may require more than one person in which case planning will also involve allocating clear roles to each person participating in the capture process.

(d) In some cases, this process may disturb or destroy the shelter site, and hence decrease the survival chances of the animal. Researchers should aim to minimise damage to important shelter sites, and wherever possible repair such damage.

ANIMAL WELFARE: All logs and rocks that have been displaced during the hand capture should be restored to their original position.

(e) Gloves (properly fitted so as not to compromise a good grip on the animal) or other personal protective equipment (e.g. glasses, long sleeve clothing, boots etc.) may be worn if required for added protection against scratches and bites.

(f) Once the animal is in hand, be mindful that unexpected escape may result in it falling to the ground causing injury. Depending on the species and skill of the operator the potential risk of this can be reduced by holding the animal closer to the ground.

(g) Captured animals must be released at point of capture (unless otherwise approved) being mindful of predators and utilising nearby shelter when appropriate. Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture (unless otherwise approved). Animals should be released at a time when they are normally active.

5.2 Hand netting (terrestrial species)

Hand-netting is a technique most commonly used to capture medium-sized ground-dwelling mammals in open terrain but it can also be used for birds, reptiles, frogs and some invertebrates. It has particular application for mammals that are not easily captured in traps or which tend to injure themselves in cage traps.

A long-handled landing net designed for recreational fishing or smaller hand nets are commonly used in this method of capture. The rate of success depends on many factors, the most important being the proximity of the animal to cover, as well as the speed and skill of the operator(s). The benefit of this technique is that it is quick and involves only short-term stress to the animals, compared to cage trapping where an animal can be subject to longer-term stress factors. The following steps are to be used as a guide to assist in the successful and safe capture of an animal using a hand net.

(a) Choose an appropriate net hoop size, handle length and net characteristics (e.g. mesh size and material), and overall net weight to suit the target animal(s). The net should be deep enough so that it can be flipped back on itself or twisted to keep the animal in the net and provide control.

(b) Ensure that the bags/containers in which the animal will be placed post capture are ready and open.

(c) Locate the target animal(s). In the case of nocturnal species, this may be done with the aid of a spotlight or head torch. Consider whether the location can be selected with terrain/vegetation characteristics that will restrict the animal's speed or the distance that the animal can run. Vegetation type, density and height will greatly impact the ability to spot the animal and use a hand net effectively.

(d) A temporary fence made of shade-cloth may help in directing movement of the animal in a preferred direction if practical. In certain circumstances involving the targeting of a specific individual (e.g. capture to remove radio collar) a temporary fence made of shade cloth or netting can be constructed to either partially or fully encircle an animal while still in its refuge. This method requires returning to the site before the animal emerges, as per the species' activity pattern, and positioning personnel along the perimeter with hand nets to intercept the animal when it vacates the refuge. This may also entail waiting on

the outside of the fence and manually collapsing the fence gently over the animal when it contacts or runs along the internal fence boundary while looking for an exit. A second person can then assist with extracting and bagging the animal while the captor gently secures the animal to prevent further stress and injury.

(e) The use of a well-coordinated team can be useful for the capture of some species that are particularly quick or flighty. In these instances, it can be helpful if the person who spots the animal remains relatively still while keeping the target in their light. Sometimes this serves to temporarily daze the animal causing it to freeze and remain in place while it assesses the danger; be mindful that some high-powered focused spotlights or head torches are capable of damaging animal eyes if direct and unrelenting so should be directed with some restraint (i.e. consider aiming slightly off center). Meanwhile the rest of the team can form a wide circle around the animal and methodically tighten the circle. It is often helpful for the circling team to minimize excessive noise and refrain from "breaking" any light that is being used to daze the animal to avoid startling it. With the circle tightened and escape routes anticipated and minimized, a single netter may be able to bring their net down on the animal.

(f) Take care when bringing the net down to not injure the animal as contact with the net rim or handle can be devastating. If a chase occurs, be mindful of foot placement to avoid stepping on the animal or refugia. A good operator will anticipate the direction of movement and place the net in front so the animal runs into the net. It is useful for backup operators to position themselves behind or beside the first operator in case they miss or the animal changes direction. Good communication is key.

(g) Once the animal is netted, flatten the rim of the net to the ground or twist the handle of the net by at least 90° so that the animal is enclosed within the net. If a mesh net is used, care must be taken as animals can injure themselves by getting caught or tangled in the mesh. Depending on the circumstances a second person may be required to control the netted animal and minimise struggling and potential harm while the other disentangles it from the net. Remove the animal from the net and place in a holding bag as quickly and gently as possible. Keep voices and excess light to a minimum to avoid further stress to the animal.

(h) Release captured animals at point of capture (unless otherwise approved) being mindful of predators and utilising nearby shelter when appropriate. Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture (unless otherwise approved). Animals should be released at a time when they are normally active.

(i) All equipment touching the animal or at risk of contamination should be properly cleaned, sanitised, and/or isolated after use to avoid cross-contamination of disease between sites and animals. This also applies to hands and any clothing making direct or indirect contact with the animal (e.g. via a soiled or urine-soaked handling bag). Refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further information.

5.3 Noosing

Noosing is a technique used to catch larger reptiles (e.g. monitors and crocodiles) and some mammals (e.g. koala) and birds (e.g. cockatoo) in limited circumstances (e.g. removing an

animal from a tree or shelter). Noosing involves the use of a rope or nylon slip loop (usually attached to a solid cylindrical rod), placed around the neck of the animal and pulled tight enough so that the animal cannot escape before it is restrained. Appropriate rod control can prevent injury to the animal and operator.

Noosing is a technique that requires highly trained personnel in order for it to be performed safely. For advice on this technique contact the department's AEC Executive Officer.

5.4 Tonging

Tonging is a technique used to capture snakes (e.g. snake tongs) or to retrieve invertebrates from pit fall traps (e.g. BBQ tongs or long-handled tweezers) using padded metal tongs to grasp the animal gently but tightly enough so that the animal cannot escape before it can be restrained. If the technique is correctly applied, there is little chance of harming the animal. The following steps should be followed to efficiently undertake hand capture with the aid of tongs.

(a) Ensure that the bags/containers in which the animal will be placed post capture are ready and open.

(b) Grasp the animal with a set of padded metal tongs gently but tightly enough to prevent the animal from escaping.

(c) Animals should only be held long enough to safely grasp them, and if necessary, to remove them from their sheltering site. The animal is then grasped in the hand/s or released into a bag/container.

It is important that the bodies of long animals (e.g. snakes, lizards etc.) are supported once they are firmly but safely grasped with the tongs (provided the safety of the handler is not at risk).

ANIMAL WELFARE: Care should be taken when grasping to ensure death or injury is not caused to the animal. Hanging animals from the neck is not acceptable and can lead to injury or death.

(d) It is recommended that larger reptiles, and specifically venomous snakes, are placed into a bag or a bin with a lid via tongs rather than hand restraining, which could result in more damage to the animal from excessive struggling (ASIH, 1987).

(e) Release captured animals at point of capture (unless otherwise approved) being mindful of predators and utilising nearby shelter when appropriate. Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture (unless otherwise approved). Animals should be released at a time when they are normally active.

(f) Tongs/tweezers should be properly cleaned and sanitised after use to avoid cross-contamination of disease between sites and animals.

5.5 Raking

Some small reptiles are difficult to catch via trapping methods and so active searching by raking through leaf litter and topsoil is sometimes employed. Raking is used to detect burrowing species by disturbing substrate under rocks and other habitats (DEC, 2004). It is

not recommended in summer unless it is conducted early morning or evening, but it is very successful during winter and early spring, when most small reptiles are generally inactive and easier to catch (Bush *et al*., 2007). This method is quite destructive to habitat and consideration should be given to the environmental cost of using the method versus the gain in knowledge of the species sampled. Knowledge of the microhabitat requirements of species can significantly improve catch rates. The following are general steps involved in the hand capture of animals with the aid of raking.

(a) Ensure that the bags/containers in which the animal will be placed post capture are ready and open.

(b) Use a garden rake to gently rake across the top of a patch of soil or leaf litter to expose sheltering animals.

(c) Capture exposed animals by hand (as per Section 4.1) and process as required.

(d) Captured animals must be released at point of capture (unless otherwise approved) being mindful of predators and utilising nearby shelter when appropriate. Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture (unless otherwise approved). Animals should be released at a time when they are normally active.

5.6 Cover boards

Many ground dwelling species of wildlife (e.g. amphibians, reptiles, small mammals, insects, etc.) seek shelter under surfaces such as rocks, boards, sheets of iron and other flat material. Cover boards (metal or wood) can be intentionally laid and left in situ for months to attract wildlife to the artificial shelter. The simple concept can be applied in many situations.

(a) Ensure that the bag/container in which the animal will be placed post capture is ready and open.

(b) Lift the cover board to observe animals sheltering underneath. Take care when lifting and replacing the cover boards to not crush or injure animals underneath. Personal protective equipment may be advisable where venomous species may be encountered.

(c) Capture exposed animals by hand (as per Section 4.1) and process as required.

(d) Release captured animals at point of capture (unless otherwise approved) being mindful of predators and utilising nearby shelter when appropriate. Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture (unless otherwise approved). Animals should be released at a time when they are normally active.

(e) If cover boards are being reused in other locations, they must be properly cleaned and sanitised after use to avoid cross contamination between sites and animals. Refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further information.

5.7 Fish net (aquatic species)

Aquatic invertebrates, tadpoles and fish may be captured using a fish net dragged through the water. Such nets are light, robust and simple to use (Marchant and Hehir, 1999).

Alternative methods should be considered for highly mobile species. The following steps should be followed when attempting hand capture of animals with the aid of a fish net.

(a) Ensure that the bags/containers in which the animal will be placed post capture are ready and open.

(b) Sweep the net through the water to catch animals. The exact technique used (e.g. rapid or slow sweep) will depend on the species being targeted.

(c) Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture (unless otherwise approved). Animals should be released at a time when they are normally active.

(d) Nets and other equipment (e.g. waders, boats, boat trailers, anchors, bilge, etc.) to be thoroughly inspected and cleaned to remove all biological material (and mud) to prevent the spread of aquatic invasive plant and animal species (including invertebrates, eggs, etc.) to other sites.

6 Competencies

A person who is competent has the knowledge, skills, and experiences that allow them to capture and handle animals successfully, and appropriately manage adverse events as required. Department personnel, and other external parties covered by the department's AEC, undertaking fauna-related activities require approval from the committee and will need to satisfy the competency requirements detailed in Table 1. Other groups, organisations or individuals using this SOP to guide their fauna capture activities are encouraged to also meet these competency requirements as well as their animal welfare legislative obligations.

It should be noted that sampling design details such as intensity and scope of the project being undertaken will determine the level of competency required and Table 1 provides advice for standard monitoring only.

Table 1 Competency requirements for Animal Handlers of projects involving the hand capture of wildlife

Competency category	Competency requirement	Competency assessment
Knowledge	Broad understanding of the framework governing the use of animals in research and environmental studies in Western Australia	Training (e.g. DBCA Fauna Management Course or equivalent training). In applications, provide details on the course provider, course name and year.
	Understanding species biology and ecology	Personnel should be able to correctly identify the likely species to be encountered for the site(s) being studied, and have an understanding of the species' biology and ecology. This knowledge may be gained through sufficient

		field experience and consultation of field guides and other literature.
	Understanding environmental conditions	Personnel should be aware of the environmental and seasonal conditions that may be expected on the project, and understand location-specific animal welfare considerations. In applications, provide details of time spent undertaking similar work in similar locations.
Fauna survey and capture skills/experience required	Experience in hand capture of target species	Personnel should be familiar with the animal welfare principles relating to hand capture (e.g. when to call off a pursuit, how firmly to grasp an animal). This experience is best obtained under supervision of more experienced personnel. In applications, provide details on the longevity, frequency & recency of experience.
Animal handling and processing skills/experience required	Experience handling terrestrial fauna	Personnel should be experienced at handling and restraint of the target species . This experience is best obtained under supervision of more experienced personnel. In applications, provide details on experience relating to the expected species or species groups.
	Experience managing disease risk in wildlife management	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and consultation of literature.

In conjunction with possessing the required understanding and knowledge of hand capture procedures and animal welfare requirements, a guide to the experience and skill requirements for an animal handler to be considered competent to capture and handle animals is as follows: (noting that some personnel with experience may still require initial supervision in unfamiliar locations or with species that they have not encountered previously):

- Total time in field: minimum 2-4 weeks undertaking hand capture of similar species.
- Recency of time in field: within the past 5 years.

7 Approvals

A licence or authorisation may be required under the *Biodiversity Conservation Act 2016* (examples below). Contact the department's Wildlife Licensing Section for more information. It is your responsibility to ensure you comply with the requirements of all applicable legislation.

- Fauna taking (scientific or other purposes) licence (Reg 25)
- Fauna taking (biological assessment) licence (Reg 27)
- Fauna taking (relocation) licence (Reg 28)
- Section 40 Ministerial Authorisation to take or disturb threatened species.

8 Occupational Health and Safety

The following departmental SOPs for wildlife survey and monitoring activities are relevant to occupational health and safety:

- SOP *Managing Disease Risk in Wildlife Management*
- SOP *Hand Restraint of Wildlife*

Departmental personnel, contractors and volunteers have duties and responsibilities under the Occupational Safety and Health Act 1984 and Occupational Safety and Health Regulations 1996 to ensure the health and safety of all involved. Fieldwork is to be undertaken in line with the department's corporate guidelines, policies and standard operating procedures, including but not limited to, risk management and job safety analyses. Further information can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/SOPs.aspx

If department personnel or volunteers are injured, please refer to the departmental Health, Safety and Wellbeing Section's 'Reporting Hazards, Near-misses and Incidents' intranet page, which can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/Reporting-Hazards,-Near-Misses-and-Incidents.aspx

9 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing hand capture of wildlife:

- Department SOP *Hand Restraint of Wildlife*
- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk in Wildlife Management*
- Department SOP *Euthanasia of Animals Under Field Conditions*

For further advice refer also to:

National Health and Medical Research Council (2013) *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council.

Environmental Protection Authority and Department of Environment and Conservation (2010) Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Eds. B.M. Hyder, J. Dell and M.A Cowan). Perth, Western Australia.

10 References

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11 Glossary of Terms

Animal handler: A person listed on an application to the department's Animal Ethics Committee who will be responsible for handling animals during the project.

Cover board: A method used to assist in the hand capture of animals by providing an artificial shelter made from pieces of plywood or similar materials aimed at attracting small and medium sized animals to utilise them, and therefore enable them to be captured when the board is lifted.

Noosing: A hand capture method where a rope or nylon slip loop is placed around the neck of the animal and pulled tight enough so that the animal cannot escape.

Raking: A hand capture method where a rake is used to loosen leaf litter and topsoil to reveal any animals.

Tonging: A hand capture method where padded metal tongs are used to grasp the animal tightly enough so that the animal cannot escape.

Appendix 2: Hand Restraint of Wildlife

Standard Operating Procedure

SC23-07 HAND RESTRAINT OF WILDLIFE

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes*.

Version 1.2

June 2023

GOVERNMENT OF WESTERN AUSTRALIA

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Version	Date	Details	Author/Reviewer	Approved By	Approval
1.0	2009	Document created	C. Freegard and V. Richter	P. Orell K. Morris	August 2009
1.1	16/05/2017	Minor revision, removed underarm hold as an approved method	G. Yeatman and M. Page	M. Page	August 2017
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Approved by the DBCA Animal Ethics Committee:

Dr Martin Dziminski

Chair, Animal Ethics Committee

Department of Biodiversity, Conservation and Attractions

Contents

1 Acknowledgements

This standard operating procedure was originally developed by Christine Freegard and Vanessa Richter, with contributions from Neil Thomas, Nicole Godfrey, Teagan Johnston, Peter Lambert and David Pearson.

2 Purpose

There are many situations where it is necessary to restrain wildlife by hand. Restraint is usually required to make observations or take measurements.

Handling or restraint should be done in a way that minimises the stress to the animal, the time that the animal restrained and the risk of injury to both the animal and the hander. Hand restraint is about finesse and technique, it has a little to do with strength. Handling of an animal can have a significant impact on its welfare, for example increased stress from prolonged restraint or physical injury of the animal due to improper handling technique.

Many species of animals are capable of inflicting serious injury to themselves or those handling them, so it is important to be familiar with the correct handling and restraint techniques during the transfer of animals into appropriate handling bags and during animal processing. For safe and effective handling, the animal handler must have detailed knowledge of the anatomy and physiology of the species being restrained; including the distance the limbs can reach to kick or strike, the degree of agility and speed (Fowler, 1978a).

This Standard Operating Procedure (SOP) provides general guidelines for the hand restraint of wildlife.

3 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department of Biodiversity, Conservation and Attractions' (DBCA) Animal Ethics Committee (AEC). However, this SOP may also be appropriate for other situations.

This SOP applies to all fauna survey and monitoring activities involving hand restraint of wildlife undertaken across Western Australia by DBCA (hereafter department) personnel. It may also be used to guide fauna related activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All department personnel involved in fauna research and management should be familiar with the content of this document.

Projects involving wildlife may require a licence/authorisation under the *Biodiversity Conservation Act 2016*. Personnel should consult the department's Wildlife Licensing Section and Animal Ethics Committee Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for all AEC approved projects. A copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

4 Animal Welfare Considerations

To reduce the level of impact of hand restraint on the welfare of animals, personnel must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented and contingencies for managing welfare issues have been identified. All handlers and volunteers involved in the project should be aware of the range of issues that they may encounter, the options that are available for reducing impacts and improving animal welfare, and the process for managing adverse events.

Department projects involving hand restraint will require approval from the department's Animal Ethics Committee. Key animal welfare considerations that should be considered when employing hand restraint are listed below and highlighted throughout the document.

4.1 Injury and unexpected deaths

If adverse events including injury, unexpected deaths or euthanasia occur then it is essential to consider the possible causes and take action to prevent further issues. Adhering to the guidance in this SOP, will assist in minimising the likelihood of adverse events. For projects approved by the department's Animal Ethics Committee, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the department SOP for *Euthanasia of Animals Under Field Conditions*. Where disease may be suspected, refer to the department SOP for *Managing Disease Risk and Biosecurity in Wildlife Management* for further guidance.

4.2 Level of impact

Wild animals are far more susceptible to stress and injury during hand restraint. There is a high level of impact on animals during hand restraint (Table 1).

It is important to be aware that improper restraint, especially of frightened or stressed animals, can lead to negative welfare impacts, including:

- Hypothermia.
- Hyperthermia.
- Stress.
- Shock.
- Exertional myopathy.
- Physical injury and pain.

Field planning must involve risk mitigation of the above potential impacts to the fullest extent possible. Note that whilst these impacts are specifically associated with hand restraint, an animal may also experience other impacts from associated procedures such as capture and

handling. Investigators must be aware that the effects of a series of stressors, such as capture, handling, transportation and marking can be cumulative.

5 Procedure Outline

Personnel handling animals should be trained in the procedure as well as in contingency methods of restraint that may be required. Handling techniques are best demonstrated and learnt under supervision in the field. The specific handling characteristics of each taxonomic group is beyond the scope of these guidelines. This SOP provides general advice only.

A number of species may have specialised requirements when it comes to handling and restraint, and general advice may not always provide the correct information; therefore, these species will need to be considered on a case-by-case basis. For example, the endangered Western Ground Parrot has detailed documentation available relating specifically to the capture and handling of this species. Personnel need to identify whether the species they are handling has specialised requirements and should seek the appropriate information and guidance before handling these species.

Determining the most suitable hand restraint method for a species will depend on a number of factors. The following are considerations prior to hand restraining an animal.

5.1 Experience and abilities of the handler(s)

It is important to consider the experience and confidence of the handlers with the species in question. Confident handlers are more likely to restrain the animals in an efficient manner that minimises stress.

It may be necessary to involve a number of personnel to restrain an animal or in the case of inexperience, have a back-up handler. The minimum number of people should be utilised to restrain the animal quickly and safely.

5.2 Species involved

The species needing to be hand restrained will give an indication of the likely behaviours to be encountered (e.g., flight, attack) and relative agility of the animal. This will guide the kind of restraint required. The size of the animal will determine whether one hand, two hands, or more than one person is required for hand restraint (Table 2).

5.3 Normal flight-fight response

Different species of animals behave differently when threatened. Some will fight, some will flee, and others will try to hide. These kinds of behaviours also apply to animals being restrained with some animals struggling excessively whilst others become submissive.

5.4 Defence mechanisms and delicate structures

Many animals have defence mechanisms or delicate structures which need to be considered when handling them such as:

- Skin: Skin is an important organ. Damage to the skin of an animal leaves it susceptible to possible bleeding and infection. Some species such as the Cane Toad secrete a toxic substance from their skin whilst other amphibians have very delicate skin that is permeable enough to allow the absorption of chemicals; therefore, clean, moist hands are required when handling.
- Tail: The tail of some large reptiles (e.g., monitors, crocodiles) can cause injury if not restrained. A defence mechanism of some reptiles (e.g., skinks, geckoes) is tail autonomy which involves the dropping and later regrowing of the tail. The loss of the tail in some species results in a loss of the animal's fat reserves and therefore decreases their chance of survival. Some rodents and bandicoots have fragile tails that can be broken, or the skin sheath removed if roughly handled or handled by the tail.
- Feathers: Damage to, severe loss or disruption of the feathers may impact the bird after release and reduce the ability to fly.
- Teeth/Beak: Many species will try and bite to defend themselves and it is therefore important to have control of the head at all times.
- Wings: Some species of birds have wings which they may use as defence (e.g., swans, pelicans) and if a handler is hit, injury can result.
- Talons/Claws: For species whose claws/talons are their main defence (e.g., birds of prey), it is important to have control of these first.
- Legs: Some species utilise their powerful legs in response to being handled (e.g., macropods). Legs cannot only cause injury to the handler but also to the animal if not controlled properly. For example, macropods can traumatise their spines if allowed to kick out with their hind legs while being held by the tail (Fowler, 1978b). Some species such as storks and waders have long delicate legs which will require careful handling.
- Venom glands: Some species are venomous and use their venom to protect themselves (e.g., venomous snakes, cane toads, invertebrates).

ANIMAL WELFARE: Exertional myopathy (EM) or capture myopathy (CM) is a condition which may be seen in many species of mammals and birds. It can result in sudden death, or death up to weeks later due to organ failure and a loss of mobility leading to higher susceptibility to predation. Among Australian species, macropods are particularly susceptible. Although EM is mostly associated with prolonged muscle exertion, it may also be seen in animals experiencing fear or anxiety without physical exertion, due to the prolonged and sustained effects of adrenaline on the circulation, as well as muscle damage and lactic acid build-up. Exertional myopathy may develop in susceptible species as a result of capture and restraint, transport, repeated handling, placing animals in an unfamiliar environment or close confinement, pursuit, or cumulative combinations of these events.

For effects on muscle damage and lactic acid build-up see Portas 2008, and for effects of loss of mobility which increases susceptibility to predation see Abbot *et al*., 2005.

Affected animals may exhibit panting, increased heart rate, shock, hyperthermia, muscle tremors and spasms, collapse, inability to hold the head up and inability to stand.

Exertional myopathy carries a guarded to poor prognosis and management should focus on preventing its occurrence through efforts to minimise stress during all interactions with wildlife. Animals should only be handled for as long as required to identify them and to collect any necessary measurements (usually no more than five minutes). At a maximum they must be released (or reach alternate end point) within 24 hours of capture. Every effort should be made to avoid stressful events during hot weather.

Records of animals suspected to be suffering from capture myopathy need to be provided to the Animal Ethics Committee as an Adverse Event report. Any animal that dies from exertional myopathy must be submitted for post-mortem examination by a veterinarian, with a copy of the report provided to the department's AEC along with an Adverse Event report.

5.6 Behavioural aspects

Wild animals are not conditioned to being handled and generally stress much faster than captive animals familiar with human presence. Wild animals should therefore be handled as efficiently as possible.

An animal's response to restraint may vary with the stage of life they are in (Fowler, 1978b). For example, an animal in oestrus or with young may behave differently to being handled than at other times. Restraint should be avoided in animals which are pregnant, with young or breeding as they will have a decreased ability to cope with more stress (Sharp *et al*., 2007).

Transporting and trapping animals changes their behaviour. These activities create high stress levels in animals, and they should be given time to settle before carrying out additional restraint (Fowler, 1978b).

5.7 Health status

The health status of an animal will affect the way it is handled. Sick or injured animals may require the use of personal protective equipment such as gloves to protect the handler from disease. Injured animals will be treated with extra caution because of the increased chance of unpredictable behaviour. Species known to carry zoonotic diseases may have specific PPE or preventative requirements for handling (e.g. bats should not be handled by personnel who have not been fully vaccinated against Australian Bat Lyssavirus).

5.6 Restraining the animal

Animals should always be approached in a calm and quiet manner (Sharp *et al*., 2007). The handler must know where and how to grasp the animal. When restraining an animal by hand, the force applied, and technique should be appropriate for the species in question (Fowler, 1978b). The animal needs to be grasped firmly enough to prevent struggling, but gently enough to avoid the risk of suffocation or damaging limbs.

Handling animals does not always go as planned so it is necessary to be sensitive, responsive and adaptable. Prolonged, stressful restraint should not be performed. Other forms of

restraint (e.g., anaesthesia) may be more suitable to help prevent injury to the animal and handler.

5.7 Assessing the comfort of restrained animals

Handlers should be familiar with the normal behaviours of the species being restrained and knowledgeable about signs of stress and discomfort (NHMRC, 2013). Animals need to be constantly assessed throughout hand restraint to ensure they are placed under the least amount of stress as possible to reduce the risk of injury and other problems such as hyperthermia and capture myopathy.

The time the animal is restrained must be kept to a minimum, with the animal being transferred into an appropriate soft or hard containment method as soon as possible. Refer to the department SOPs *Animal Handling and Restraint using Soft Containment* and *Transport and Temporary Holding of Wildlife* for further advice.

Personnel need to be aware of signs of stress in an animal when assessing the comfort of the animal being restrained (Table 1).

In assessing the comfort of a restrained animal, personnel will need to consider:

1. The animals breathing and whether the pressure you are exerting on the animal is too strong. Personnel must keep an eye on the heart rate and respiration of the animal. Gasping and cyanosis (bluing) of the nose and/or lips are obvious signs that too much pressure is being used.

2. Ensuring that the animal is not forced into awkward or unnatural positions that may cause injury. Exerting too much pressure on limbs can cause fractures or dislocations.

3. The surroundings, this includes what the animal can see, hear, smell and to a lesser extent, taste. Animals must not be exposed to excessive wetness, extremes of temperature , bright light and loud or sudden noises. Handlers should not smoke or eat immediately prior or during hand restraint of animals.

Table 1. Signs of stress in animals during hand restraint (Choy, 2009; N. Thomas, pers. comm. 2009).

Animal Group	Signs of Stress
Birds	• Vocalisation • Excessive struggling • Defecation • Increase in heart rate • Panting/heat stress
Reptiles and Amphibians	• Excessive struggling • Gaping of the mouth • "Swimming" in the air (turtles/tortoises) • Panting/heat stress • Self-biting
Mammals	• Vocalization • Clenching of teeth • Self-biting • Increase in heart rate • Panting/heat stress • Animal is limp or closes its eyes • Aggression • Urination/defecation • Excessive struggling • Cyanosis (bluing) of the nose and/or lips
Macropods	• Vocalisation • Teeth grinding • Excessive licking • Increase in heart rate • Panting/heat stress • Excessive salivating

6 Hand Restraint Methods

General advice on suitable hand restraint techniques is contained below, however, training and supervision from experienced personnel in animal handling is required before a person may be considered competent.

ANIMAL WELFARE: Hand restraint is stressful for animals and so it is essential that handling time is kept to a minimum. Animals should be transferred into holding bags as soon as possible and/or have their eyes covered.

6.1 One-handed hold

This method is suitable for small birds, small to medium lizards, and small rodents (Table 2). It involves the whole animal being restrained in a single hand. The thumb and index finger to restrain the head (Fig. 1).

Figure 1. A bearded dragon restrained using thumb and index finger with the rest of the hand supporting the body. Photo: Christine Freegard (DBCA).

6.2 Two-handed hold

The two-handled hold is a common method where both hands are used to hold the animal, usually one to restrain the head and the other to support the body and control the legs/tail (Fig. 2 and 3). The head is held away from the body, and particularly the face, of the handler. This method is suitable for medium to large birds, snakes, lizards, and mammals (Table 2).

Figure 1. A carpet python restrained with one hand controlling the head (left). Photo: Christine Freegard (DBCA). A varanid restrained with one hand around the front legs and one hand around the back legs (right). Photo: Astrid Kendrick (DBCA).

Figure 2. A parrot restrained with one hand controlling the head, and the other securing the feet, wings and supporting the body (left). A quenda restrained with one hand holding the neck and head, and the other holding the back legs and supporting the body (right). Photo: Vanessa Richter (DBCA).

6.3 Three-finger hold

This method is suitable for reptiles to restrain the head of an animal (Table 2). The thumb and middle finger are placed on either side of the animal's head and the index finger placed on top of the head (Fig. 4). If required, the other hand can be used to support the rest of the animal's body.

Figure 3. The head of a carpet python restrained using a three-finger hold. Photo: Christine Freegard (DBCA).

6.6 Scruffing

This method is suitable for small to medium rodents (e.g., *Mus musculus* and smaller individuals of *Rattus* spp.), small mammals, and for microbats (initial capture only; Table 2).

Using the thumb and index finger, the loose skin on the scruff of the neck is grasped (Fig. 5). This technique is not suitable for species which tend to slough skin such as *Zyzomys* spp.

Figure 5. A dunnart restrained using scruffing technique. Photo: Nicole Willers (DBCA).

6.7 Cupping

This method is suitable for most small birds, and small to medium lizards. It involves the whole animal being enclosed in one or two hands (Fig. 6). This technique is not suitable for species that may bite, sting or scratch hands. It is also not suitable for species that may be sensitive to overheating if restrained this way for anything more than a few seconds such as amphibians (Table 2).

Figure 6: A finch cupped in hands. Photo: Vanessa Richter (DBCA).

6.8 Ringers hold

This method is suitable for small birds and can also be used on small rodents and mammals (Table 2). This is generally a one-handed restraint method which involves the animal being caged in the fingers with the head protruding between the thumb and index finger or between the index finger and middle finger (Fig. 7).

Figure 7. A red-tailed phascogale held in one hand between the index and middle fingers. Photo: Nicole Willers (DBCA).

6.9 Reverse ringers hold

This is suitable for small birds, but only for those that do not have sharp beaks as the head is not properly restrained (Table 2). It is a one-handed bird restraint method in which the bird is grasped with its back and closed wings against the palm of the hand, with the head facing downward towards the handler's wrist (Fig. 8).

Figure 8. A lorikeet held in one hand using the ringers hold (left); and a finch being restrained using a reverse ringers hold (right). Photo: Vanessa Richter (DBCA).

ANIMAL WELFARE: If hand restraint is not possible due to excessive struggling which compromises the health of the animal or risks of injury to the handler or animal, other forms of restraint (e.g., anaesthesia) should be applied or the animal should be released.

6.10 Amphibian hold

Small and more delicate species should be held by a foot and the body should be supported. The animal should not be able to kick its legs. Alternatively use the thumb and index finger to hold the hind legs at thigh level, the body and front legs are supported by resting on the same hand or the other hand.

Frogs should be handled as little as possible because handling removes skin secretions and predisposes the frog to fungal infections, while continuous holding in the hand can result in

overheating. It is preferable for the hands to be wet during restraint as this reduces drying of the animal's skin.

Tadpoles and larvae have thin delicate skin that is very easily damaged by the slightest handling. Therefore, direct contact handling of tadpoles and larvae is to be avoided; instead, these amphibian stages should be scooped using nets or similar and examined through clear flexible lightweight plastic bags (e.g., Ziplock or freezer bags) containing water.

6.11 Temporary holds

Pistol grip

This method is a variation of the three-finger hold and is suitable for small to medium mammals. This method is extremely good for pacifying agitated animals and allows easy exposure and measuring of the head. The ring and little fingers are placed under the chin, with the middle and index finger going over the head to cover the eyes and the thumb going behind the head to restrict head movement. This is best done while the animal is still in the bag and then exposing the head once the animal is restrained. For smaller animals just the index finger over the head is adequate to cover the eyes.

Figure 9. A chuditch being restrained and head exposed using pistol grip temporary hold. Photo: Nicole Willers (DBCA).

Tail grab

This method is suitable for temporary hold of medium sized macropods.

ANIMAL WELFARE: DO NOT use this hold for rodents as it may cause detachment of the tail sheath.

It involves grabbing the base of the tail where it is thick and muscular and lifting the animal off the ground directing the legs away from the handler (Fowler, 1978b). The animal can then be placed into an appropriate handling bag (refer to the Department SOP for Animal Handling

and Restraint using Soft Containment). To minimise the risk of spinal injury when using this technique, the animal should not be restrained in this manner for extended periods of time without supporting the body. This technique is suitable for medium sized macropods.

Figure 10*. A rock wallaby grasped by the base of the tail using the tail grip. Photo: Nicole Willers/DBCA (left) and Roger Groom (right).*

ANIMAL WELFARE: Ejection of pouch young can occur in some macropods. Personnel that may encounter these species during handling must be familiar with the department SOP for *Care of Evicted Pouch Young*. Records need to be kept on orphans, their care and fate for annual reporting requirements forthe department's AEC approved projects.

Table 2. A guide to suitable hand restraint methods for different animal groups. Note: Some techniques are not suitable for animals of a particular size. Where this is relevant, an appropriate size range has been included in brackets.

Animal Group	One-handed hold	Two-handed hold	Three-finger hold	Scruffing	Cupping	Ringers hold	Reverse ringers hold	Amphibian hold	Temporary holds (pistol grip/tail grab)
Birds	✓ (small)	✓ (medium to large)	X	X	✓ (small)	✓ (small)	✓ (small)	X	
Amphibians	Initial capture only	X	X	X	few seconds only	X	X	✓	
Snakes	X	✓	✓	X	X	X	X	X	
Lizards	✓ (small to medium)	✓	✓ (small to medium)	X	✓ (small)	X	✓ (small e.g., *Pogona*)	✓ (small e.g., *Pogona*)	
Turtles	X	✓	X	X	X	X	X	X	
Bats	X	✓ (medium to large)	X	✓ microbats	X	X	X	X	
Rodents	✓ (small)	✓	X	✓ (small, those that do not slough skin)	✓ (small)	✓ (small)	X	X	
Small mammals (e.g., small dasyurids)	X	X	X	Initial capture only	X	✓	✓	X	
Medium sized mammals (eg brushtail possum, rock wallaby)	X	✓	X	X	X	X	X	X	Pistol grip, tail grab for transfer (macropods)
Large mammals	X	✓	X	X	X	X	X	X	

7 Maintaining hygiene

Maintaining hygiene is very important and precautions must be taken to prevent the risk of cross infection between animals and from animals to humans. Sick or injured animals require higher hygiene considerations due to the possibility of zoonosis.

Personnel must take precautions to minimise the risk of disease transmission to protect themselves, their families and the public. All materials and equipment used in the capture, holding transport and manipulation of animals must be cleaned and maintained in a way that minimises the assessed risk of disease transmission. Contaminated equipment must be disinfected between animals and between locations where the equipment is used.

Refer to the department SOP for *Managing Disease Risk and Biosecurity in Wildlife Management* for further advice.

8 Preventing Injuries to animals and handlers

Many animals do not tolerate physical restraint and therefore there is an increased potential for injury to the animal or handler. If the potential for human or animal injury reaches an unacceptable level the animal should not be handled. If handling the animal results in excessive stress to the animal (or handler) then all attempts to restrain the animal should be stopped at once. It may also be necessary to limit all attempts to measure the animal (recording ID and sex only) and immediately releasing the animal to reduce the likelihood of injury to the animal or handler.

Where animals are restrained by hand, injury to animals and handlers can be prevented or minimised by:

- Using personal protection equipment:
    - Long sleeve clothing: to reduce the risk of cuts and scratches to the arms and legs.
    - Goggles/face mask/safety glasses: to protect eyes from animals with long beaks (e.g., storks) or animals which secrete substances (e.g., cane toad).
    - Gloves (leather): can be useful for animals with sharp claws, teeth and spines or venom glands.
    - Ear plugs: can protect ears in situations where personnel are exposed to loud/excessive noise for long periods of time (e.g., working with cockatoos).
- Knowing the correct restraint techniques.
- Utilising as many people as required to safely restrain an animal with minimal stress.
- Limiting the time, the animal is restrained.
- Using alternatives methods of restraint (e.g., anaesthesia) if an animal is excessively resisting hand restraint.

- If an animal is injured during hand restraint, superficial wounds should be treated, refer to the department SOP for *First Aid for Animals*.
- If an animal is seriously injured, refer to the flowchart in the department SOP for *Euthanasia of Animals Under Field Conditions* to make the decision on whether or not to euthanase or seek veterinary care.

9 Competencies

A person who is competent has the knowledge, skills, and experiences that allow them to capture and handle animals successfully, and appropriately manage adverse events as required. Department personnel, and other external parties covered by the department's Animal Ethics Committee, undertaking fauna-related activities require approval from the committee and will need to satisfy the competency requirements (Table 3). Other groups, organisations or individuals using this SOP to guide their restraint of fauna are encouraged to also meet these competency requirements as well as their animal welfare legislative obligations.

It should be noted that sampling design details such as intensity and scope of the project being undertaken will determine the level of competency required and Table 3 provides advice for standard monitoring only.

Table 3 Competency requirements for Animal Handlers of projects involving the hand restraint of wildlife

Competency category	Competency requirement	Competency assessment
Knowledge	Broad understanding of the framework governing the use of animals in research and environmental studies in Western Australia	Training (e.g., DBCA Fauna Management Course or equivalent training). In applications, provide details on the course provider, course name and year.
	Understanding species biology and ecology	Personnel should be able to correctly identify the likely species to be encountered for the site(s) being studied and understand the species' biology and ecology. This knowledge may be gained through sufficient field experience and consultation of field guides and other literature.

Animal handling and processing skills/experience required	Experience in hand restraint of fauna	Personnel should be experienced at handling and restraint of the range of species likely to be captured. This experience is best obtained under supervision of more experienced personnel. In applications, provide details on experience relating to the expected species or species groups.
	Experience managing disease risk and biosecurity in wildlife management	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and consultation of literature.

In conjunction with possessing the required understanding and knowledge of hand restraint methods and animal welfare requirements, a guide to the experience and skill requirements for an animal handler to be considered competent to restrain animals by hand is as follows: (noting that some personnel with experience may still require initial supervision in unfamiliar locations or with species that they have not encountered previously):

- Total time in field: minimum 2-4 weeks undertaking hand restraint of similar species.
- Currency of time in field: within the past 10 years.

10 Approvals

A licence or authorisation may be required under the *Biodiversity Conservation Act 2016* (examples below). Contact the department's Wildlife Licensing Section for more information. It is your responsibility to ensure you comply with the requirements of all applicable legislation.

- Fauna taking (scientific or other purposes) licence (Reg 25)
- Fauna taking (biological assessment) licence (Reg 27)
- Fauna taking (relocation) licence (Reg 28)
- Section 40 Ministerial Authorisation to take or disturb threatened species.

Occupational Health and Safety

The following departmental SOPs for wildlife survey and monitoring activities are relevant to occupational health and safety:

- SOP *Managing Disease Risk and Biosecurity in Wildlife Management*
- SOP *Hand Restraint of Wildlife*

- *SOP First Aid for Animals*

Departmental personnel, contractors and volunteers have duties and responsibilities under the Occupational Safety and Health Act 1984 and Occupational Safety and Health Regulations 1996 to ensure the health and safety of all involved. Fieldwork is to be undertaken in line with the department's corporate guidelines, policies and standard operating procedures, including but not limited to, risk management and job safety analyses. Further information can be found at

https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/SOPs.aspx

If department personnel or volunteers are injured, please refer to the departmental Health, Safety and Wellbeing Section's 'Reporting Hazards, Near-misses and Incidents' intranet page, which can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/Reporting-Hazards,-Near-Misses-and-Incidents.aspx

11 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing to capture wildlife with aluminium box traps:

- Department SOP *Hand Capture of Wildlife*
- Department SOP *Animal Handling and Restraint using Soft Containment*
- Department SOP *Transport and Temporary Holding of Wildlife*
- Department SOP *Care of Evicted Pouch Young*
- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk and Biosecurity in Wildlife Management*
- Department SOP *Euthanasia of Animals Under Field Conditions*

For further advice refer also to:

National Health and Medical Research Council (2013) *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council.

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13 Glossary of Terms

Animal handler: A person listed on an application to the department's Animal Ethics Committee who will be responsible for handling animals during the project.

Large mammal: Any mammal weighing over 5500 g.

Medium bird: A bird that requires two hands for restraint.

Restraint: Restriction of an animal's movement by hand (Sharpe *et al*., 2007).

Small bird: A bird that can be restrained with one hand.

Small/medium sized mammal: Any mammal weighing up to 5500 g.

Appendix 3: Transport and Temporary Holding of Wildlife

Standard Operating Procedure

SC22-11 TRANSPORT AND TEMPORARY HOLDING OF WILDLIFE

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes*.

Version 1.2

August 2022

GOVERNMENT OF WESTERN AUSTRALIA

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Version	Date	Details	Author/Reviewer	Approved By	Approval
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1.1	16/05/2017	Minor revision, helicopter added as a transport method and statement about min and max temperatures added.	G. Yeatman and M. Page	M. Page	August 2017
1.2	30/07/2021	Revision of content & clarification of procedures	C. Sims, A. Robey and F. Carpenter	M. Dziminski	August 2022

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Approved by the DBCA Animal Ethics Committee:

Dr Martin Dziminski
Chair, Animal Ethics Committee
Department of Biodiversity, Conservation and Attractions

Contents

1 Acknowledgements

This standard operating procedure was originally developed by Christine Freegard and Vanessa Richter, with contributions from Peter Orell, Peter Mawson, Claire Stevenson, Neil Thomas and Stephanie Hill.

2 Purpose

In most situations, animals that are trapped are released at their point of capture shortly after the required data is collected. In certain circumstances, such as translocation, relocation, or the collection of live voucher specimens, the temporary holding and/or transport of live animals is required. Animals may also need to be held temporarily for identification purposes prior to their release back at the point of capture within 24 hours.

This Standard Operating Procedure (SOP) provides advice on the temporary holding and transport of wildlife using hard and soft containment methods.

3 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department of Biodiversity, Conservation and Attractions' (DBCA) Animal Ethics Committee (AEC). However, this SOP may also be appropriate for other situations.

This SOP applies to the transportation and temporary holding of wildlife that is undertaken across Western Australia by DBCA (hereafter department) personnel. It may also be used to guide fauna related activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All department personnel involved in fauna research and management should be familiar with the content of this document.

Projects involving wildlife may require a licence/authorisation under the *Biodiversity Conservation Act 2016*. Personnel should consult the department's Wildlife Licensing Section and AEC Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for all AEC approved projects. A copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

4 Animal Welfare Considerations

To reduce the level of impact of transport and temporary holding on the welfare of animals, personnel must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented during transport and temporary holding, and to ensure that contingencies for managing welfare issues have been identified. Ensure that all handlers and volunteers involved in the project are aware of the range of issues that they may encounter, the options that are available for reducing impact and improving animal welfare, and the process for managing adverse events.

Department projects involving transport and temporary holding of fauna will require approval from the department's Animal Ethics Committee.

The key animal welfare considerations that should be considered when transporting and temporarily holding fauna are listed below and are highlighted throughout the document.

4.1 Injury and unexpected deaths

If adverse events including injury, unexpected deaths or unplanned requirement for euthanasia occur then it is essential to consider the possible causes and take action to prevent further issues. Adhering to the guidance in this SOP will assist in minimising the likelihood of adverse events. For projects approved by the department's Animal Ethics Committee, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the department SOP for *Euthanasia of Animals Under Field Conditions*. Where disease may be suspected, refer to the department SOP for *Managing Disease Risk and Biosecurity in Wildlife Management* for further guidance.

4.2 Level of impact

The impact of transport and temporary holding of wildlife is potentially high given the animals are completely dependent on the conditions provided by the personnel responsible for their welfare.

Potential impacts include:

- Trauma (e.g., injuries inflicted due to inappropriate restraint / containment).
- Dehydration.
- Starvation.
- Hypothermia/hyperthermia.
- Distress (due to confinement, movement, noise, smells, changes in environment and personnel, or inability to exercise natural hiding/refuge behaviour).
- Capture myopathy.
- Death.
- Spread of diseases and parasites.

Field planning must involve risk mitigation of the above potential impacts to the fullest extent possible. Note that whilst these impacts are specifically associated with transport and temporary holding, an animal may also experience other impacts from associated procedures such as trapping and marking. Investigators must be aware that the effects of a series of stressors, such as capture, handling, transportation, sedation, anaesthesia and marking are cumulative.

5 Approved methods

5.1 Temporary holding

There are many methods used to temporarily hold live animals (Table 1). The most suitable method will depend on the species being held and the duration of containment. Various soft and hard containment options exist, and their suitability will depend on the species, transport method, duration and conditions.

Table 1 Methods approved for temporary holding and transport of wildlife.

Containment Type	Containment Method	Used For	Holding Time	Cautions and Notes
Soft	Calico bag	Small mammals (e.g., rodents, small dasyurids), birds, reptiles, and dry-skinned frogs (e.g., *Heleioporus* sp.)	Up to 24 hours	Take care to check bags for holes, weak seams and loose threads. For larger frogs, material such as moist leaf litter or soil must be included in the bag and must remain damp to ensure animals cannot desiccate. Material dampness should be checked periodically throughout the duration of holding and bags should be kept in a cool environment and as dark as possible. Soil/sand, leaf litter or other substrate should be provided as shelter for burrowing reptiles. Some species, particularly blind snakes and small lizards can escape tied bags. The opening of the bag should be folded twice for these species. Bags with venomous snakes must be clearly labelled and preferably secured inside a solid container that is also clearly labelled. It is usual to attach flagging tape with a warning. Mammals, particularly rodents, may chew through bags and escape. It may be preferable to double bag rodents to minimise this risk. For transport, mammals, reptiles and frogs must be further secured within hard containment. Birds may have specialised requirements for transport. If personnel anticipate they will be transporting or holding birds with specialised requirements, specific containment procedures must be detailed in any AEC application. It is important to ensure that there is sufficient air, temperatures are not excessive, and there is no risk of animals being crushed or injured from one another inside a hard container. A note of caution is that small rodents in particular do not fare well in bags for extended durations.
Soft	Heavy cotton denim or synthetic (e.g., polar fleece)	Medium-sized mammals (e.g., brushtail possums, bandicoots, bettongs, quolls)	Up to 24 hours	Take care to check bags for holes, weak seams and loose threads. Darker bags can quickly calm animals but take care to ensure animals do not overheat. Material should be open weave and 'breathable'. Stretchy materials can reduce risks of injury and aggravating exertional/stress response to containment (especially in macropods). For transport, medium-sized mammals must be further secured within hard containment.

Soft	Heavy cotton drill or denim	Larger macropods (e.g., rock-wallabies, kangaroos)	Up to 24 hours	Road transport: Animals are often suspended in bags to reduce the harshness of vehicle transport. A mattress / piece of foam should be placed beneath the animals for additional protection. Air transport: Animal kept within a heavy cotton drill/denim bag placed within a pet pack (one individual per pack).
Hard	Plastic container (ventilated)	Frogs, tadpoles and frog spawn	Up to 24 hours	Include water (tadpoles and most egg masses), damp leaf litter or other material as appropriate for individual species and life stages.
Hard	Elliott trap	Small mammals (e.g., rodents, small dasyurids)	Up to 24 hours	One individual to each trap. Include a layer of insulative material (e.g., native vegetation). Tape doors closed and secure Elliott traps within larger, ventilated hard containment (e.g., pet pack). Take particular care of temperature management.
Hard	Cage trap	Medium-sized mammals (e.g., brushtail possums, bandicoots, bettongs, quolls)	Up to 24 hours	Animals must first be contained within an appropriate soft containment bag that is secured to the side of the cage trap. Base of cage trap should be lined with a cushioning layer (e.g., towels, high density foam).
Hard	Pet pack	Medium-sized mammals (e.g., brushtail possums, bandicoots, bettongs, quolls) and medium to large-sized birds (e.g., cockatoos)	Up to 24 hours	For mammals: Must first be contained within an appropriate soft containment bag that is secured to the side of the pet pack. Base of pet pack should be lined with absorbent material (e.g., puppy liners) and a cushioning layer (e.g., towels, high density foam). For birds: Consider the biological and behavioural requirements of the bird. For perching species, a branch/pole or built-in stand should be provided.
Hard	Species-specific transportation box	Birds and small mammals	Up to 24 hours	A cushioning and absorbent substrate (e.g., shredded paper, leaf litter/vegetation) should be provided. For birds: Consider the biological and behavioural requirements of the bird. For perching species, a branch/pole or built-in stand should be provided.

ANIMAL WELFARE: Consider both the biological and behavioural requirements of animals when subjecting them to containment or confinement for extended periods of time such as that required for transport.

ANIMAL WELFARE: Extreme temperatures can lead to death. Frogs kept in plastic bags are extremely susceptible to high temperatures. Ensure that bags are not left in direct sunlight, are kept cool and keep holding time to a minimum. Under extreme conditions (e.g. >35°C) additional mitigation measures should be applied. For all other species kept in fabric bags, temperature management is also essential, as is keeping noise or other disturbance to a minimum.

In hot weather, or if animals are to be retained for extended periods, bags should be checked regularly, and animals kept hydrated (e.g. placing moist cotton wool inside the bag). Note: Calico bags can wick moisture away and rapidly desiccate animals (especially frogs and some species of reptile e.g. geckos), and if bags with damp sand in them are allowed to completely dry, the hardened sand can trap the animal causing harm and possibly death.

In cool or windy conditions an animal held in a damp bag (e.g. urine, water) can rapidly become hypothermic and should be transferred to a new handling bag and placed in a protected area if holding for any extended period.

In some cases, hard containment methods may be used to store multiple animals held in individual soft containment bags so that hard containers may be stacked for transport whilst maximising ventilation. However, containment bags must be restrained within the hard containment so that the bagged animals cannot roll and injure, suffocate each other or restrict air flow. In the case of pet packs, the containment bags can be tied to the diagonal corners of a pet pack.

5.2 Transport

Animals may be transported by land, by air (aeroplane / helicopter) or by boat depending on the circumstances and distance needing to be travelled (Table 2).

ANIMAL WELFARE: The journey must be planned to ensure prompt delivery of wildlife and undertaken to ensure appropriate timing of arrival consistent with natural activity patterns. As part of the planning for each journey, arrangements to manage any delay, breakdown or other emergency should be established to minimise risks to animal welfare during transport. This extends to conditions of transport (e.g., rough tracks/seas), and methods used to secure animals may need to be adapted as appropriate. Contingency arrangements may involve written arrangements, and journey plans, or arrangements that are in place for rest stops, particularly for long-distance journeys. Animals must be released within 24 hours of capture unless justification can be provided and is approved by the department's AEC.

Table 2 Modes of transport for movement of wildlife

Transport Method	Situation Used
Vehicle (by land)	Short and medium distances (less than 12 hours duration)
Aeroplane (pressurised compartment)	Long distance or remote
Helicopter	Short and medium distances
Boat	Island to mainland or vice versa. Up or down rivers where road transport is less efficient.

ANIMAL WELFARE: In general animals are better able to cope with stress at low temperatures and low humidity. Transport should not occur if temperature cannot be maintained below 25°C.

Regardless of the mode of transport, temperature must be managed and, if possible, monitored. As a general rule, the temperature range should not exceed 25°C or fall below 15°C, but this is dependent on the species. There are a number of other things to consider for each of these modes of transport and these are outlined in the following sections.

ANIMAL WELFARE: Wildlife must be assessed as fit for the intended journey unless being transported for the purpose of veterinary care or rehabilitation.

5.2.1 Ground transport by vehicle

(a) Animals must be in a covered space and well secured to prevent escape or movement about the vehicle during travel.

(b) The temperature where the animals are held must not exceed 25°C. A temperature thermometer with multiple sensors is recommended so that the temperature where the animal is held can be monitored by the driver.

(c) Some vehicles do not have floor insulation from the heat generated by the vehicle exhaust system, and this can lead to heat stress and potentially death. The temperature must be monitored, and a false bottom can be used to insulate the vehicle.

(d) Animals must not be placed in the boot or on the dash of a vehicle.

(e) Never leave collected animals where they may be exposed to direct sunlight, get wet or get too hot or cold.

5.2.2 Air transport by aeroplane or helicopter

(a) Animals must be in a covered space and well secured to prevent escape or movement about the aeroplane or helicopter during travel.

(b) Ensure that transportation by air is undertaken in accordance with International Air Transportation Association (IATA) *Live Animal Regulations*.

(c) When transporting live animals by jet turbine helicopter, animals are to be placed in the cabin or if this is not possible then in a well-ventilated boot (free of other cargo), away from the heat of the jet engine exhaust and checked regularly. Secure boxes should allay any fear that pilots may have about animals escaping.

(d) Do not stow animals in close proximity to exhaust gases or subject to radiated heat generated by the engine/s.

5.2.3 Boat transport

(a) Animals must be in a covered space and well secured to prevent escape or movement about the boat during travel.

(b) Animals must be stowed in a dry, well-ventilated location. It is preferable to place the animals near the centre of the boat to provide for a smoother ride, particularly if experiencing rough sea conditions.

6 Procedure Outline

6.1 Construction of temporary holding containers

(a) The containers must be designed, constructed and appropriately sized for the species and purpose that they are being used.

(b) The containers must be secure and escape-proof.

(c) The container must provide adequate ventilation.

(d) There must be adequate nesting or bedding material available appropriate for the species being transported.

(e) Materials used in the construction of crates / containers should be able to be cleaned effectively.

6.2 Care during temporary containment

(a) Limit exposure of animals to sudden movements, temperature extremes, noise, visual disturbance, strong or unfamiliar smells and vibration.

(b) For most species, the temperature should be kept to below 25°C and above 15°C and good ventilation provided.

(c) Food and water/moisture must be provided when necessary. Generally wild animals being held or transported for <12-24 hrs are unlikely to be interested in eating and provision of free water is impractical during transport. However, a small amount of high-moisture-content, nutritious and tempting food (e.g., apple, berry, other fruit or vegetables for herbivores; moist petfood, mince, insects or mealworms for small insectivores and carnivores) can be included in the holding container. This may assist in reducing physiological stress and dehydration associated with transport and holding.

(d) Ensure that animals are separated, except for pouch young.

ANIMAL WELFARE: Fixed partitions should be considered for use between individuals when travelling in hilly, bumpy or high-traffic areas, to prevent animals being thrown around or injured.

(e) Animals should be monitored frequently for signs of distress, although this needs to be balanced against the desirability of limiting disturbance.

(f) Avoid unnecessary handling.

(g) Administer tranquilising agents by skilled personnel where appropriate.

(h) Ensure animals are not left where they may be accidentally trampled or forgotten.

(i) Mammals transported in pet packs and cage traps should be secured in species-appropriate soft containment prior to placement in container. To prevent potential injury, the container size should ensure that an animal cannot roll around in it or bags should be tied/secured to the side.

6.3 Cleaning and disinfecting temporary holding containers

Temporary holding containers must be cleaned and disinfected after each use. Advice on cleaning and disinfection is available in the Department SOP for *Managing Disease Risk and Biosecurity in Wildlife Management.*

6.4 Record keeping for transport of animals

(a) Ensure that both suppliers and recipients of animals have satisfactory delivery procedures, with animals being received by a responsible person and appropriate paperwork is completed.

(b) Label all temporary holding containers with the species, sex, date and capture site details upon containment of an animal. You may also need to further label containers with dangerous animals, e.g., “Caution Venomous Snake”.

(c) For translocations, ensure that a Translocation Proposal has been written in accordance with the department *Corporate Guideline No. 36* and approved.

(d) If animals are being transported interstate, then an export permit is required to be issued under the *Biodiversity Conservation Act 2016*. Note that this permit will not be issued unless the State to which the fauna is being exported has approved the fauna entering that State. If animals are being received from interstate, then an import permit is required.

(e) Animals being transported to the WA Museum must have accompanying specimen data. An animal without data is useless for nearly all purposes for which it may have been collected.

7 Competencies

A person who is competent has the knowledge, skills, and experiences that allow them to hold and transport animals successfully, and appropriately manage adverse events as required. Department personnel, and other external parties covered by the department’s Animal Ethics Committee, undertaking fauna-related activities require approval from the committee and will need to satisfy the competency requirements detailed in Table 3. Other groups, organisations or individuals using this SOP to guide their fauna holding and transport activities are encouraged to also meet these competency requirements as well as their animal welfare legislative obligations.

It should be noted that the intensity and scope of the project being undertaken will determine the level of competency required and Table 3 provides general advice only.

Table 3 Competency requirements for Animal Handlers of projects involving transport and temporary holding of wildlife

Competency category	Competency requirement	Competency assessment
Knowledge	Broad understanding of the framework governing the use of animals in research and environmental studies in Western Australia	Training (e.g., DBCA Fauna Management Course or equivalent training). In applications, provide details on the course provider, course name and year.
	Understanding species biological and behavioural requirements	Personnel should understand the species' biological and behavioural requirements. This knowledge may be gained through sufficient field experience and consultation of field guides and other literature.
	Understanding environmental conditions	Personnel should be aware of the environmental and seasonal conditions that may be expected on the project and understand location-specific animal welfare considerations. In applications, provide details of time spent undertaking similar work in similar locations.
Fauna holding and transport skills/experience required	Experience holding and transporting fauna	Personnel should be familiar with the animal welfare principles for transport and temporary containment of wildlife and be familiar with the most appropriate containment methods for the species of interest to the project. This experience is best obtained under supervision of more experienced personnel. In applications, provide details on the longevity, frequency & recency of experience.
Animal handling and processing skills/experience required	Experience handling fauna	Personnel should be experienced at handling the species of interest to the project. This experience is best obtained under supervision of more experienced personnel. In applications, provide details on experience relating to the expected species or species groups.
	Experience managing disease risk in wildlife management	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and consultation of literature.

In conjunction with possessing the required understanding and knowledge of temporary holding and transport procedures and animal welfare requirements, a guide to the experience and skill requirements for an animal handler to be considered competent to hold and transport animals is as follows: (noting that some personnel with experience may still require initial supervision in unfamiliar locations or with species that they have not encountered previously):

- Total time in field: minimum 2 weeks undertaking fauna holding and transport.
- Recency of time in field: within the past 5-7 years.
- Minimum 20 individuals of similar species handled.
- Minimum 2 weeks undertaking similar activity in similar environments with similar species.

8 Approvals

A licence or authorisation may be required under the *Biodiversity Conservation Act 2016* (examples below). Contact the department's Wildlife Licensing Section for more information. It is your responsibility to ensure you comply with the requirements of all applicable legislation.

- Fauna taking (scientific or other purposes) licence (Reg 25)
- Fauna taking (biological assessment) licence (Reg 27)
- Fauna taking (relocation) licence (Reg 28)
- Section 40 Ministerial Authorisation to take or disturb threatened species.

Additional approvals may be required for the transport of wildlife (e.g., approved Translocation Proposal, export or import permit).

9 Occupational Health and Safety

The following departmental SOPs for wildlife survey and monitoring activities are relevant to occupational health and safety:

- SOP *Managing Disease Risk and Biosecurity in Wildlife Management*
- SOP *Hand Restraint of Wildlife*

Departmental personnel, contractors and volunteers have duties and responsibilities under the *Occupational Safety and Health Act 1984* and *Occupational Safety and Health Regulations 1996* to ensure the health and safety of all involved. Fieldwork is to be undertaken in line with the department's corporate guidelines, policies and standard operating procedures, including but not limited to, risk management and job safety analyses. Further information can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/SOPs.aspx

If department personnel or volunteers are injured, please refer to the departmental Health, Safety and Wellbeing Section's 'Reporting Hazards, Near-misses and Incidents' intranet page, which can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/Reporting-Hazards,-Near-Misses-and-Incidents.aspx

9.1 Driver fatigue

Driver fatigue is a concern when animals are being transported for translocation by road. Often drivers have been involved in trapping the animals and therefore may have worked long hours and had interrupted sleep. There are also long distances involved in some translocations which increase the risk of driver fatigue. Appropriate measures, such as regular rest stops or back-up drivers, should be utilised to minimise the risk of driver fatigue.

10 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing to temporarily hold and transport fauna:

- Department SOP *Animal Handling and Restraint using Soft Containment*
- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk and Biosecurity in Wildlife Management*
- Department SOP *Euthanasia of Animals Under Field Conditions*
- Department SOP *Hand Restraint of Wildlife*

For further advice refer also to:

National Health and Medical Research Council (2013) *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council.

11 Glossary of Terms

Animal handler: A person listed on an application to the department's Animal Ethics Committee who will be responsible for handling animals during the project.

Hard containment: Use of hard materials to contain the movement of animals to assist handling and restraint.

Soft containment: Use of soft materials to contain the movement of animals to assist handling and restraint.

Appendix 4: Care of Ejected Pouch Young

Standard Operating Procedure

SC22-16 CARE OF EJECTED POUCH YOUNG

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes*.

Version 1.2

February 2023

GOVERNMENT OF WESTERN AUSTRALIA

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February 2023

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Revision History Log

Version	Date	Details	Author/Reviewer	Approved By	Approval
1.0	2009	Document created	C. Freegard and V. Richter	P. Orell and K. Morris	March 2009
1.1	22/05/2017	Minor revision, with clarification of Procedure Outline and statement about wildlife rehabilitation. *	G. Yeatman, G. Anderson, and M. Page	M. Page	August 2017
1.2	30/07/2021	Revision of content & clarification of procedures	A. Robey, J. Wayne, and J. Renwick	M. Dziminski	February 2023

* Previously called Care of Evicted Pouch Young

Approvals: Version 1.2

Approved by the DBCA Animal Ethics Committee:

Dr Martin Dziminski
Chair, Animal Ethics Committee
Department of Biodiversity, Conservation and Attractions

Contents

1 Acknowledgements

This standard operating procedure was originally developed by Christine Freegard and Vanessa Richter, with contributions from Peter Orell, Peter Mawson and Stephanie Hill.

2 Purpose

Ejecting pouch young is common in some members of the Macropodidae, Potoroidae and Peramelidae families (particularly woylies *Bettongia penicillata ogilbyi*, boodies *Bettongia lesueur*, and quenda *Isoodon fusciventer*). Any joey caught with an adult female should never be released by itself.

This Standard Operating Procedure (SOP) outlines procedures for four options for dealing with the situation of a pouch young being ejected from its mother's pouch: taping, soft release, keeping and euthanasing.

3 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department of Biodiversity, Conservation and Attractions' (DBCA) Animal Ethics Committee (AEC). However, this SOP may also be appropriate for other situations.

This SOP applies to all fauna survey and monitoring activities undertaken across Western Australia by DBCA (hereafter department) personnel. It may also be used to guide fauna related activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All department personnel involved in fauna research and management should be familiar with the content of this document.

Projects involving wildlife may require a licence/authorisation under the *Biodiversity Conservation Act 2016*. Personnel should consult the department's Wildlife Licensing Section and Animal Ethics Committee Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for all AEC approved projects. A copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

4 Animal Welfare Considerations

To reduce the level of impact of ejected pouch young on the welfare of animals, personnel must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented during animal handling and contingencies for managing welfare issues have been identified. Ensure that all handlers and volunteers involved in the project are aware of the range of issues that they may encounter, the options that are available for reducing impacts and improving animal welfare, and the process for managing adverse events.

Department projects involving animal handling will require approval from the department's AEC. Key animal welfare considerations that should be considered are listed below and highlighted throughout the document.

4.1 Injury and unexpected deaths

If adverse events including injury, unexpected deaths or unplanned requirement for euthanasia occur then it is essential to consider the possible causes and take action to prevent further issues. Adhering to the guidance in this SOP will assist in minimising the likelihood of adverse events. For projects approved by the department's Animal Ethics Committee, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the department SOP for *Euthanasia of Animals Under Field Conditions*. Where disease may be suspected, refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

4.2 Level of impact

The intention of this procedure is to have a beneficial positive impact on the welfare of animals involved. Inappropriate care of pouch young can have a high impact on the welfare of animals (e.g. if the young develop hypothermia, dehydration etc.). Euthanasia is a possible end point of this procedure if considered the best outcome for the animals involved.

5 Procedure Outline

5.1 Equipment

If undertaking a project where the ejection of pouch young is likely, at least one 'joey kit' should be kept in each vehicle. The number of joey kits carried should be proportional to the expected risk. The joey kit should comprise the following:

- a well-ventilated box with a lid
- a heat pack or hot-water-bottle and thermos of hot water
- makeshift pouches (e.g. beanies or purpose-made)

5.2 What to do immediately after the pouch young is ejected

The most common time for pouch young to be ejected is when the mother becomes aware of someone approaching the trap. Occasionally young are ejected whilst inside a handling bag or on release. It is important to be efficient at separating the mother and young, however it is also important to take care not to rush as this can lead to the mother escaping and leaving an orphan. Place each in a separate bag as soon as possible to reduce the chance of the young being injured.

Ejected young should be immediately placed somewhere warm. This is usually inside someone's clothing, preferably against skin for maximum heat transfer. Human body temperature is too cool for pouch young so this is only a temporary solution. The joey should be transferred to makeshift pouch and be kept warm with a heat pack or hot-water-bottle inside appropriate containment until it is reunited with its mother, delivered to a licenced wildlife rehabilitator or euthanased.

ANIMAL WELFARE: Records need to be kept on ejected pouch young, their care and fate for annual reporting requirements of projects approved by the department's Animal Ethics Committee.

5.3 Taping in pouch young

Taping is the preferred option for ejected pouch young and should be used wherever possible.

5.3.1 When to tape

Tape in small pouch young that have been ejected or are likely to be ejected when their mother is released. Only tape in those pouch young that are small enough to fit back into the pouch such that the opening of the pouch can be completely closed. Hairless or lightly furred pouch young are never too large to reinsert into their mother's pouch (and should never be left with the mother out of the pouch). Generally, woylies smaller than 200 g (fully haired, eyes open) should be taped in (pouch young up to 260 g have been successfully taped in and released).

Before inserting larger joeys, check the pouch for any hairless infants. If there are any infants present in the pouch, the larger joey has already permanently emerged from the pouch (i.e. should not be taped in) but probably is still dependent on the mother and therefore should be 'bagged'.

5.3.2 How to tape

(a) Pouch young insertion is a lot easier when the mother is not struggling and not completely stretched out. Her back should be slightly curved and legs not completely stretched back. At least two people are required: one to hold the mother and the other to insert the pouch young.

(b) Open the pouch and then place the pouch young in the pouch opening, allowing it to pull itself in while guiding it into position: head first, upside down with its back to its mother's stomach, pouch lifted out and forward. Ensure the pouch lining is not pulled out when opening as this reduces the size of the pouch available for the joey to climb back into.

(c) Once the pouch young is in the pouch it should be allowed to settle and rest with its side flush against the body wall of the mother. Hind legs and tail should be inside the pouch and not protruding through the pouch opening.

ANIMAL WELFARE: Be gentle when tucking tails and legs into the pouch; they are fragile.

(d) Use a piece of Fixomull®(adhesive surgical tape) longitudinally to close the mouth of the pouch, keeping clear of the cloaca and placed no higher than the lower edge of the mother's rib cage.

Ensure the hind legs and their ranges of movement are not impeded by the tape.

Take particular care in positioning tape on bandicoots because the pouch opening and cloaca are close together. A 'V' shape may be cut out of one end of the tape to assist placing the tape with sufficient adherence without blocking the cloaca.

(e) Massage the tape into the fur by gently pinching and rolling the tape and fur/skin between fingers to ensure good adhesion.

(f) If the first piece of tape is narrow and there is some doubt about the tape holding (e.g. if the pouch young is large), another piece of tape may be placed across the belly over the top of the existing tape covering the pouch opening.

The tape should extend no further than the laterals (sides) of the animal (i.e. not onto the back).

Extending further than the laterals may cause the tape to remain attached to the mother longer than is desirable and threaten the survival of the joey. If the tape is too long where the ends join over the back, it will result in the death of the joey and is debilitating and potentially lethal for the mother.

(g) Be patient and take the time to secure the pouch young.

Figure 1 A woylie joey taped into its mother's pouch Photo: Christine Freegard/DBCA.

5.4 Releasing mother and joey

There are different options for releasing the mother depending on whether the joey has been taped into the pouch and depending on the mother's stress level. The options are to either release immediately after taping the joey in, or to conduct a soft release.

5.4.1 Immediate release

(a) When releasing the mother with a taped pouch, plan and ensure an exit from the bag which is clear of ALL obstructions including field kits and people, and logs and trees within at least 2 m. Ensure all is quiet and people are behind the release point.

(b) With the mother still in the handling bag, place her feet on the ground before carefully removing the bag. This will help ensure that the mother does not kick or scratch the tape off during release or before she has found refuge.

Alternatively, place the bag on the ground and allow the animal to settle down close to the mouth of the bag in a way that will allow a clean release, and then quietly fold the bag off the eyes of the animal. Allow the animal to leave on its own terms and in its own

time. CAUTION: If the mother has struggled in the bag after you have released your grip she may have kicked the tape off. Check and re-tape if necessary.

(c) Observe the animal as it moves away to make sure that the tape stays on. Keep quiet and listen out for the calls (a hissing noise) of an ejected pouch young. If in doubt trace the path of the mother and look and listen for abandoned young. If the mother has ejected the pouch young and the pouch young is found, refer to Section 4.4.

(d) Check that there is no pouch young in the bag. If the pouch young is left in the bag, refer to Section 4.4.

5.4.2 Soft release

A soft release is when the mother and joey (whether or not it is taped in) are left in an untied bag in a sheltered location, allowing them to leave the bag on their own terms. This bag should be heavy weight with a dense weave (e.g. dark cotton drill or fleece) and should ideally be the bag the mother is initially restrained in after she has exited the trap. Transferring an animal from one bag to another prior to soft release is likely to cause stress and increase the risk of the mother kicking the tape off or leaving without her joey.

Soft release should be considered if the pouch young is particularly large, attempts to return the pouch young to the pouch have not succeeded, or if a young-at-heel is still present and a new born infant is also present in the pouch. Soft release should also be considered if the pouch young has been successfully taped in but the mother is highly stressed/agitated.

If the pouch young is unfurred and the initial attempt to reinsert has failed, it will be necessary to leave the mother in the bag in a quiet and secure place to settle down and then re-attempt to reinsert the pouch young into the pouch rather than conduct a soft release.

Note: When conducting a soft release, personnel MUST be able to return to the release site the next day to check that the bag has been vacated.

(a) Find a well contained and sheltered position to leave the animals. Any sheltered depressions are ideal (e.g. under logs, rocky outcrops, dense bushes or in burnt out stumps). Consider how the shade will move during the day to ensure that the position will not be exposed to direct sunlight.

(b) Mark the location with flagging tape and label the tape with the day's date. Ensure this mark is visible from the reference point/road.

(c) Clearly record the location of the bag in relation to a particular trap point on the data sheet.

(d) Ensure equipment is packed away, all is quiet and all other people are at a distance.

ANIMAL WELFARE: If the joey is not taped in, do not introduce the joey to the bag with its mother until you are situated at the soft release site.

(e) Carefully lay out the bag in the sheltered position and allow the mother to settle. If possible, secure a rear corner of the bag to reduce the risk of the animal getting tangled in the bag when exiting, or from hopping away in the bag.

(f) If the joey is not taped in, introduce the joey into the bag and place as close to the mother as possible without aggravating the mother. CAUTION: Take care to ensure the

mother does not see an escape route as this will increase the risk of her escaping and leaving her joey.

(g) Twist or fold the mouth of the bag in a way that will allow the mother and joey to exit from the bag with moderate ease. Ensure the positioning of the bag does not hinder their exit.

(h) Allow the mother and joey to settle whilst lightly securing the bag opening and then retreat slowly and quietly (e.g. avoid crunching leaf litter and rubbing of wet weather gear). The first couple of minutes after your retreat are the most crucial as the mother may still be agitated.

(i) Later that afternoon, you can return to the release site and observe the bag from a distance to check if the animals have already left. Note: you must do this with considerable caution to avoid the risk of disturbing the animals and causing the mother to bolt. Often both the mother and joey will still be in the bag and will likely leave in the evening. If the bag appears to be empty, approach the bag quietly as you sometimes may find that the mother has left but the joey is still in the bag. Refer to Section 4.4 for guidance on what to do if only the joey is left in the bag.

(j) If the bag appeared to have both mother and joey in it in the afternoon, you must return again the following morning to check whether the mother and joey have left. Approach the bag quietly as sometimes you may find the mother and joey are still in the bag. If just the joey is still in the bag, refer to Section 4.4. If they are both still in the bag, quietly gather the mouth of the bag in one hand and then make sure that they are still alive by softly placing a hand on the animal on the outside of the bag.

If the mother and joey are still in the bag and alive, you will need to assess the situation and make some decisions:

- If the joey was taped in, check on the taping and consider immediate release if the taping is still secure and/or the mother has significantly calmed down.
- If mother and joey appear to be fine, consider providing them with a bait ball/food and leaving them in the bag for another day. Check to make sure the exit from the bag is not too difficult. Repeat steps (h) to (j).

> **ANIMAL WELFARE**: Some peanut butters have begun using xylitol as a sugar substitute. There are no data available regarding the toxicity of xylitol to Australian wildlife, but xylitol is toxic to dogs. If using universal bait, please check the ingredient list on the peanut butter and avoid brands containing xylitol.

- Depending on the situation, you may need to consider taking the mother and joey into care, euthanasing the joey or euthanasing both the mother and joey.

5.5 Reuniting, keeping or euthanasing joeys

5.5.1 Reuniting joeys

If there is a possibility of the mother being recaptured on the grid or transect, then it may be possible to reunite the mother with its joey. If the joey is furred, and is not looking lethargic or dehydrated, keep it warm in a joey kit. Electrolytes can be fed instead of joey formula for up to 24 hours – this reduces chances of diarrhoea and rejection of mothers milk when

reunited. The joey can be cared for and accompany the trapping team to the original capture location until such a time as the mother can be recaptured. CAUTION: Once a mother and pouch young are separated, the mother's milk supply starts reducing and therefore this option should only be attempted for 1-2 days.

ANIMAL WELFARE: It is important to keep track of ejected pouch young to ensure that they are returned to the correct mother and trap location.

An animal handler needs to be allocated responsibility for the care of the joey. If the mother is recaptured, conduct another soft release to give them another chance to reunite. If the mother and joey cannot be reunited, then the animal handler will need to arrange euthanasia or co-ordinate/organise rehabilitation of the joey (see Sections 4.4.2 and 4.4.3 for further guidance)

The following is general advice on temporarily caring for joeys:

(a) The first priority in caring for pouch young is to keep them warm. The pouch young should be placed under clothing against skin until they are transferred to a joey kit. A joey placed against skin will not keep the joey sufficiently warm for extended periods because the warmth does not surround the joey as it would in a pouch. It is recommended that the joey is placed in a warm cloth or knitted pouch, on or next to a hot water bottle. Note: be mindful not to overheat larger, fully furred joeys.

(b) Joey milk, electrolytes and equipment should be located where accessible.

(c) Keep the animal dry and out of the sun and begin appropriate feeding as soon as possible.

(d) Record the date, mother's ID, and place of capture on flagging tape tied to the joey pouch. Make sure that the incident is clearly noted on the trapping data sheet (e.g. 'Joey ejected & abandoned, UNDER CARE').

5.5.2 Keeping joeys

A decision to keep or euthanase a joey must take into consideration:

- The chances of the animal's survival: This will depend on levels of stress, injury and the stage of development and elapsed time since separation from mother. Unfurred pouch young have a low chance of survival and practically no chance if cold and/or severely bruised.
- The time required to reach appropriate care: If care cannot be given within 6 hours, the joey's chances of survival are significantly reduced and the amount of suffering increases.
- The likely fate of the animal if taken into care: Rehabilitation of dependent offspring must only be considered if consistent with the department guidelines *Making Decisions on the Fate of Rehabilitated Fauna* and the department *Code of Practice for Wildlife Rehabilitation in Western Australia*. As outlined in the Code of Practice for Wildlife Rehabilitation in Western Australia, wildlife must be promptly euthanased when:

  • it is necessary to alleviate unreasonable and/or incurable pain, distress, trauma, sickness or injury;

- further treatment is not practical, including where extensive veterinary intervention is likely to be required for the animal to be rehabilitated;
- recovery is not expected such that the animal can be successfully released to the wild; or
- an animal requires an extended period in captivity which is likely to be detrimental to its future release

Joeys should only be kept alive if the animal has a good chance of survival, appropriate care can be given within six hours and the animal can be successfully rehabilitated back into the wild.

It is preferable to screen and select an appropriate wildlife rehabilitator prior to the survey or monitoring activity, ensuring that they have experience with the specific species and capacity to provide care. The Wildcare Helpline can be reached on (08) 9474 9055 to assist with locating an appropriate licenced wildlife rehabilitator. Go to https://www.dpaw.wa.gov.au/about-us/contact-us/wildcare-helpline for more information.

Note: The Chief Investigator is responsible for the fate of the animal after rehabilitation, and must ensure the animal is released back to the capture site or elsewhere in consultation with the Species and Communities Program Principal Zoologist. This is particularly important for threatened species.

Keeping track of the ultimate fate of the joey is also important for annual reporting requirements for projects approved by the department's Animal Ethics Committee.

5.5.3 Euthanasing joeys

Pouch young are sometimes ejected from the pouch long before the trap is checked and these young, particularly when unfurred, loose heat rapidly which greatly reduces their chances of survival. Ejected pouch young may also be trampled by their mother, inflicting injuries such as scratches, punctures and bruising. Pouch young that are very cold and/or injured have a poor chance of survival and the most humane option is to euthanase.

Refer to the department SOP for *Euthanasia of Animals Under Field Conditions* for further guidance. Euthanasia should only be conducted by experienced personnel.

6 Competencies

A person who is competent has the knowledge, skills, and experiences that allow them to capture and handle animals successfully, and appropriately manage adverse events as required. Department personnel, and other external parties covered by the department's Animal Ethics Committee, undertaking projects involving trapping of species that may eject pouch young require approval from the committee and will need to satisfy the competency requirements detailed in Table 1. Other groups, organisations or individuals using this SOP to guide their decision making in relation to ejected pouch young are encouraged to also meet these competency requirements as well as their animal welfare legislative obligations.

It should be noted that sampling design details such as intensity and scope of the project being undertaken will determine the level of competency required and Table 1 provides

advice for standard monitoring only.

Table 1 Competency requirements for Animal Handlers of projects that may involve the care of ejected pouch young

Competency category	Competency requirement	Competency assessment
Knowledge	Broad understanding the framework governing the use of animals in research and environmental studies in Western Australia	Training (e.g. DBCA Fauna Management Course or equivalent training). In applications, provide details on the course provider, course name and year.
	Understanding species biology and ecology	Personnel should be familiar with the behaviour of species prone to ejecting pouch young and be aware of ways to reduce the stress of these species. This knowledge may be gained through sufficient field experience and consultation of field guides and other literature.
Animal handling and processing skills/experience required	Experience handling marsupials	Personnel should be experienced in handling and restraint of species prone to ejecting pouch young. This experience is best obtained under supervision of more experienced personnel. In applications, provide details on experience relating to the expected species or species groups.
	Experience managing disease risk in wildlife management	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and consultation of literature.

In conjunction with possessing the required understanding and knowledge of ejected pouch young care procedures and animal welfare requirements, a guide to the experience and skill requirements for an animal handler to be considered competent to care for ejected pouch young is as follows: (noting that some personnel with experience may still require initial supervision in unfamiliar locations or with species that they have not encountered previously):

- Minimum 30 individuals of similar species handled.
- Minimum 6 successful joey interventions (taping of pouch young and soft release).
- Recency of time in field: within the past 5 years.

7 Approvals

A licence or authorisation may be required under the *Biodiversity Conservation Act 2016* (examples below). Contact the department's Wildlife Licensing Section for more

information. It is your responsibility to ensure you comply with the requirements of all applicable legislation.

- Fauna taking (scientific or other purposes) licence (Reg 25)
- Fauna taking (biological assessment) licence (Reg 27)
- Fauna taking (relocation) licence (Reg 28)
- Section 40 Ministerial Authorisation to take or disturb threatened species.

If a pouch young is taken into care, the rehabilitator must comply with the requirements of Regulation 35 of the *Biodiversity Conservation Regulations 2018*.

8 Occupational Health and Safety

The following departmental SOPs for wildlife survey and monitoring activities are relevant to occupational health and safety:

- SOP *Managing Disease Risk in Wildlife Management*
- SOP *Hand Restraint of Wildlife*

Departmental personnel, contractors and volunteers have duties and responsibilities under the Occupational Safety and Health Act 1984 and Occupational Safety and Health Regulations 1996 to ensure the health and safety of all involved. Fieldwork is to be undertaken in line with the department's corporate guidelines, policies and standard operating procedures, including but not limited to, risk management and job safety analyses. Further information can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/SOPs.aspx

If department personnel or volunteers are injured, please refer to the departmental Health, Safety and Wellbeing Section's 'Reporting Hazards, Near-misses and Incidents' intranet page, which can be found at

https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/Reporting-Hazards,-Near-Misses-and-Incidents.aspx

9 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing to handle and restrain animals using soft containment:

- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk in Wildlife Management*
- Department SOP *Euthanasia of Animals Under Field Conditions*

For further advice refer also to:

National Health and Medical Research Council (2013) *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council.

Department of Biodiversity, Conservation and Attractions (2019) *Code of Practice for Wildlife Rehabilitation in Western Australia*, Department of Biodiversity, Conservation and Attractions, Perth. Code of Practice for Wildlife Rehabilitation in Western Australia (dpaw.wa.gov.au)

Department of Biodiversity, Conservation and Attractions (2020). Western Australian Wildlife Rehabilitation Standards and Guidelines – Making decisions on the fate of rehabilitated fauna. Wildlife Rehabilitation Standards and Guidelines - Making decisions on the fate of rehabilitated fauna (dpaw.wa.gov.au)

10 Glossary of Terms

Animal handler: A person listed on an application to the department's Animal Ethics Committee who will be responsible for handling animals during the project.

Joey: A dependant juvenile marsupial encompassing both 'pouch young' and 'young-at-heel'.

Pouch young: Offspring of a marsupial residing within the mother's pouch.

Soft release: Procedure where an animal is left inside an open bag to self-release.

Taping: Procedure where a pouch young is returned to its mother's pouch and adhesive tape applied to the opening to temporarily prevent the mother ejecting the young.

Young-at-heel: A fully developed and furred dependant offspring living outside the pouch but still drinking its mother's milk.

Appendix 5: Cage Traps for Live Capture of Terrestrial Vertebrates

Standard Operating Procedure

SC22-07 CAGE TRAPS FOR CAPTURE OF TERRESTRIAL VERTEBRATES

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes*.

Version 1.3

February 2023

GOVERNMENT OF WESTERN AUSTRALIA

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Revision History Log

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Approved by the DBCA Animal Ethics Committee:

Dr Martin Dziminski
Chair, Animal Ethics Committee
Department of Biodiversity, Conservation and Attractions

Contents

1 Acknowledgements

This standard operating procedure was originally developed by Christine Freegard and Vanessa Richter, with contributions from Peter Orell, Peter Mawson and Neil Thomas.

2 Purpose

Cage trapping is a common method used for monitoring many species of small to medium-sized mammals. Cage traps usually operate using a treadle plate mechanism, which is set off when an animal steps on the elevated trigger plate and springs the door closed. Cage traps will also catch a range of non-target species including birds and reptiles.

This Standard Operating Procedure (SOP) provides advice on the use of cage traps for non-lethal trapping of terrestrial vertebrate fauna.

3 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department of Biodiversity, Conservation and Attractions' (DBCA) Animal Ethics Committee (AEC). However, this SOP may also be appropriate for other situations.

This SOP applies to all fauna survey and monitoring activities involving the use of cage traps undertaken across Western Australia by DBCA (hereafter department) personnel. It may also be used to guide fauna related activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All department personnel involved in cage trapping should be familiar with the content of this document.

Projects involving wildlife may require a licence/authorisation under the *Biodiversity Conservation Act 2016*. Personnel should consult the department's Wildlife Licensing Section and Animal Ethics Committee Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for all AEC approved projects. A copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

4 Animal Welfare Considerations

To reduce the level of impact of cage trapping on the welfare of animals, personnel must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented during trap set up and trap checking and contingencies for managing welfare issues have been identified. Ensure that all handlers and volunteers involved in the project are aware of the range of issues that they may encounter, the options that are available for reducing impacts and improving animal welfare, and the process for managing adverse events.

Department projects involving cage trapping will require approval from the department's AEC. Key animal welfare considerations that should be considered when cage trapping are listed below and highlighted throughout the document.

4.1 Injury and unexpected deaths

If adverse events including injury, unexpected deaths or unplanned requirement for euthanasia occur then it is essential to consider the possible causes and take action to prevent further issues. Adhering to the guidance in this SOP will assist in minimising the likelihood of adverse events. For projects approved by the department's AEC, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the Department SOP for *Euthanasia of Animals Under Field Conditions*. Where disease may be suspected, refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

4.2 Level of impact

Potential animal welfare impacts of cage trapping include:

- Capture myopathy (particularly for Macropods)
- Trauma (e.g. head or nose injuries from hitting walls of the trap; toe / nail injuries from capture under treadle or in mesh)
- Smaller non-target species stuck in mesh
- Stress as a result of harsh environmental conditions within the trap (i.e. temperature).
- Distress (caused by confinement, discomfort, social isolation, separation of mother and young, exposure to predators, ants, etc.)
- Predation

If the cage traps are properly monitored and preventative actions are utilised then the impact should be small and only short-term. Field planning must involve risk mitigation of the above potential impacts to the fullest extent possible. Note that whilst these impacts are specifically associated with the use of cage traps, an animal may also experience other impacts from associated procedures such as handling and transport. Investigators must be aware that the effects of a series of stressors, such as capture, handling, transportation, sedation, anaesthesia and marking can be cumulative.

5 Approved Trap Types

Large Cage: Galvanised wire mesh cage trap (approx. 45cm x 45cm x 90cm) with a treadle plate release mechanism. Large cages are used primarily for feral cat (*Felis catus*) trapping.

Small Cage: Galvanised wire mesh cage trap (20cm x 20cm x 56cm) with a treadle plate release mechanism. Collapsible forms are available. Used for most medium-sized mammals such as chuditch (*Dasyurus geoffroii*), quenda (*Isoodon fusciventer*), brushtail possums (*Trichosurus vulpecula*) and woylies (*Bettongia penicillata ogilbyi*). Small cages also catch small Dasyurids and rodents as well as Varanids, large skinks and occasionally birds.

Smaller cage traps have been specifically manufactured for northern quolls (*Dasyurus hallucatus*).

Some old style traps used a trigger mechanism attached to a bait hook hanging from the roof of the trap, which when tugged on, releases the door, or hooks were simply included to keep bait off ground. Traps with hook-release mechanisms are not acceptable. Where traps with

bait hooks are still in use, the hook must be completely closed to form a loop so that an animal is unable to get caught on the hook.

Many cage traps used in Western Australia are manufactured by Sheffield Animal Traps (previously Sheffield Wire Products) and so are sometimes referred to as "Sheffields." Cage traps manufactured with different trigger mechanisms may also be appropriate and their use is not excluded, provided they do not pose additional welfare risks to animals (see reference to 'hooks' above). Projects approved by the department's AEC preferring to use alternative cage style traps to those mentioned here may do so if they describe in detail the differences in design and are able to report survivorship rates and welfare impacts which are acceptable to the AEC.

All traps should be checked for sharp edges, protrusions, or gaps/holes large enough for entrapment of digits/limbs which can cause injury, regardless of age of trap (some new traps can have rough or sharp edges from the milling/cutting process.) Proper function of the doors and trigger mechanisms should also be checked as malfunctioning devices may pose a risk by partially trapping an animal.

The solid nature of cage traps means that animals can injure themselves whilst inside the trap. To minimise these injuries soft trap options have been developed and are covered in the Department SOP for *Soft Cage Traps for Capture of Macropods*. These soft traps are preferred for species that are particularly prone to injury or capture myopathy and have been effectively used for a variety of species including rock-wallabies (*Petrogale lateralis*), tammar wallabies (*Notamacropus eugenii derbianus*) and mala (*Lagorchestes hirsutus*).

Figure 1 A cage trap with hessian and vegetation cover. Photo: Christine Freegard/DBCA

6 Procedure Outline

6.1 Setting and positioning traps

(a) The location and configuration of trap placement (e.g. transect or grid) as well as the number of traps will be determined by the purpose of the study and should be planned before commencing the survey. Consider the target species' likely use of habitat and home range and welfare implications of trap placement when designing trap configuration and layout.

Example: Transects of 50 small cage traps spaced at 200 m intervals (total 10 km) have been used as the standard method for monitoring target species under the *Western Shield* program.

(b) Trap locations must be marked so that no traps are missed when checking or removing them (e.g. with flagging tape which is labelled and using a numbering system which uniquely identifies each trap). A GPS reading for each trap point is strongly recommended. Permanent monitoring trap sites should also be marked using a permanent marker (e.g. numbered dropper post). The location information for permanent monitoring transects and their trap points should be recorded on datasheets and a database.

(c) If setting traps along roads or vehicle tracks, the traps must be set so that they minimise the impact on the animals. Traps should be placed away from the roadside (generally a distance of 5m or greater on publicly accessible roads and tracks) so that they are not readily visible from the road to avoid public curiosity and possible theft of traps, and to reduce the disturbance on trapped animals from passing vehicles.

(d) Trap placement:

ANIMAL WELFARE: Trap placement can greatly affect animal welfare. Consider the climate of the area you are trapping in and the species biology (e.g. thermoregulation characteristics) when choosing a trap position. Traps need to be placed in suitable locations that provide shelter from the sun and protection from rain to reduce exposure of trapped animals. For example, consideration needs to be given to the movement of the sun (and therefore shade), prevailing winds and drainage in wet conditions. Consider the orientation of the sun and the period of the day when the captured animal will be in the trap.

Thick trap covers that provide protection from the elements and reduce the sense of exposure by the animals are required (refer point (f) below). If the traps are likely to capture species that are prone to panic or stress (e.g. woylies), trap placement should also allow animal handlers to approach the traps without increasing the stress of the animal (e.g. approach trap from the side rather than the front, reduced noise from walking on leaf litter, and minimal talking).

Do not place traps on or in the vicinity of ant nests.

(e) Traps must be set in level positions using natural cover wherever possible. Debris and/or vegetation should be cleared from under the trap to ensure stability and prevent obstructions from stopping the dropping and locking of the trap door. In some areas where the ground is uneven or ground vegetation makes it difficult for the door to close,

it may be appropriate to place a short straight stick, no longer than the width of the cage, under the bottom front edge of the trap to lift the bottom lip of the trap mouth just off the ground and provide clearance for the door to close easily. Note that this must be done in a way that won't reduce trap stability and won't create issues for an animal stepping into the trap.

(f) Cage traps must have adequate shelter and protection for the welfare of captured animals. Cage traps should be covered with heavy weight hessian (or similar material with the same protective qualities) to provide captured animals with security and shelter from the elements. Place the hessian over the top of the trap and wrap around to cover exposed sides. The cover needs to be secured to ensure that it cannot be easily removed by an animal and wind cannot blow the hessian off the trap. Options include using a rock or log, nestling the trap into a bush, tucking the edges of the bag under the trap (ensuring the stability of the trap is not impeded) or piling sand on the edges of hessian. Ensure that the trap release mechanism is not impeded by the hessian or method used to secure it.

(g) Before the trap is left, it is important to re-check that the mechanism is working properly, the trap cover is effective and secure, and the trap is positioned to take advantage of shade in the morning. Faulty equipment reduces the opportunity to trap animals and can result in poor data and reduce the value of the trapping effort.

(h) All traps must be accounted for before and after each trapping session.

6.2 Baiting traps

When choosing the type of bait for your traps always consider the target species and possible non-target captures. Bait is intended to lure an animal into the trap and for some species, provides a small amount of food while the animal is trapped.

Small Cage: The standard bait used in small cages is a mixture of peanut paste and rolled oats which is also known as "universal bait" (*Note: sardines may increase the attraction of ants and you may want to consider excluding them from the bait if ants are an issue*). Small cages require a quantity about half to a third of the size of a golf ball. Refer to Appendix II for more information.

ANIMAL WELFARE: Some peanut butters have begun using xylitol as a sugar substitute. There are no data available regarding the toxicity of xylitol to Australian wildlife, but xylitol is toxic to dogs. If using universal bait, please check the ingredient list on the peanut butter and avoid brands containing xylitol.

Alternative baits such as tuna, sardines, chicken and bacon can be considered when targeting carnivorous mammals such as chuditch. Use of a meat bait may also increase captures of reptiles, particularly varanids and skinks.

If using a meat bait, personnel should maintain good hygiene practises when handling the baits, such as washing and disinfecting their hands after contact with the bait, and avoiding touching their face, mouth and trapping equipment until cleaned. Incorrect handling and hygiene surrounding meat baits can potentially lead to foodborne infections, such as Salmonella. Gloves can also be worn when preparing or handling meat baits. Gloves should be removed when no longer handling baits to avoid contaminating other equipment.

Other bait types or ingredients may be used if these have been identified as appropriate and approved for use for a particular project and/or species.

Care must be taken when baiting traps to ensure that the bait is placed clear of the treadle plate and does not impede the closing mechanism. To avoid bait rolling underneath the treadle plate and rendering the trap inoperative, it is recommended that universal bait balls are slightly squashed so that they cannot roll under the treadle.

Baits should be replaced when their effectiveness as a lure is reduced (e.g. when the odour of the bait is reduced or gone) or if the bait may impact on an animal's health if consumed (e.g. rancid). Baits should be replaced rather than additional baits placed in the cage – more bait in the cage may increase the probability of the treadle being impeded. Collect and remove all old baits entirely rather than leaving on site as to prevent any alternative bait source and potential missed captures.

6.3 Checking traps

ANIMAL WELFARE: In determining the duration and frequency of trapping you should consider the purpose of your study and the potential welfare impacts from recapturing animals on multiple occasions (e.g. limitations on feeding, welfare of dependent young). Consider the duration and frequency that will allow the goal of the activity to be achieved with the minimal impact on animals. Some animals become "trap happy" (entering traps on multiple consecutive nights) and this can impact their wellbeing by disrupting behaviours such as normal feeding, foraging, breeding and defending territories. This is particularly relevant to small mammals (e.g. honey possums) which due to their small size, are at risk of death if prevented from feeding. Where honey possums are prevalent, a sugar solution (e.g. Spark liquid) should be available when checking traps.

Avoid trapping in breeding seasons where lactating females may be separated from dependent young or when there is an increased likelihood of injury or separation of dependent young (e.g. brushtail possums during pouch emergence). However, many species breed throughout the year making it impossible to completely avoid trapping animals at sensitive times. If captured, lactating animals should be released as soon as possible. If the same lactating female is caught on successive nights, consideration should be given to moving or closing the trap.

Avoid trapping or close traps in extreme weather conditions. Plan ahead and monitor long-range and daily weather forecasts.

For programs such as *Western Shield* monitoring it is recommended that traps are set for a minimum of four consecutive nights.

(a) All traps must be accounted for during each day's trapping. Personnel undertaking the trapping should keep tallies of traps to ensure that all are checked. This is the responsibility of the person in charge at the survey location on the day. There is no excuse for leaving traps unchecked.

ANIMAL WELFARE: The timing and frequency of trap checking and clearing should be determined by considering the behaviour and biology of the target species (and potential by-catch species) in association with the environmental conditions at the site. Trap checking timing and frequency should be reviewed and adapted when and if conditions change or adverse events occur. Traps may need to be checked more frequently throughout the day

and/or night if prolonged trap confinement or environmental conditions are likely to increase the impact on animal welfare and affect survivorship.

(b) Where nocturnal species are being targeted, traps must be checked early in the morning during the period when temperatures will have minimal effect on the trapped animals (no later than 3 hours after sunrise but as early as possible in high temperature conditions). If checking of traps cannot be completed within this timeframe, trap numbers must be reduced or the number of personnel increased before any further trapping occurs.

(c) Traps must either be closed on checking and re-opened late afternoon, or, if they need to remain open (i.e. targeting diurnal animals), the Animal Ethics application must provide information to show that leaving traps open during the day will not impact animal welfare. Traps remaining open during the day must be in a shaded position, and consideration should be given to more frequent checking throughout the day, particularly in hot weather or if there are non-target captures.

(d) An appropriate handling bag must be carried when approaching a trap to ensure rapid removal of the animal from the trap (see the department SOP for *Animal Handling and Restraint using Soft Containment*).

(e) Take care when approaching the trap and minimise noise during your approach (reduce noise from walking, leaf crunch, vehicles, talking etc.). A second handling bag may be used to quickly cover the front of the trap (the exposed front of the trap) which may aid in calming agitated trapped animals, particularly woylies.

(f) Bait within each trap should be checked daily and replaced when necessary. Traps without bait reduce the validity of trapping results.

(g) The presence of ants in the trapping area can lead to detrimental impacts on captured animals. A small amount of surface insecticide (e.g. a liquid-based permethrin product such as Coopex®) can be applied around and below traps to discourage ants. Extreme care must be taken to ensure that no free-standing liquid droplets remain when using liquid-based permethrin as absorption/ingestion can be lethal to frogs and reptiles Consider alternatives in areas with a high likelihood of capturing amphibians or reptiles or conservation significant amphibians or reptiles. Always read the MSDS of chemicals before use. If ants become highly attracted to the trapping area, remove and relocate the traps to a more suitable position. One way to reduce risk of ant infestation is to remove bait each morning when clearing traps and replace when resetting in the afternoon.

ANIMAL WELFARE: If moderate to high numbers of ants are identified at a trap site, or if small numbers of ants cause welfare issues, then the trap must be closed or moved to another location.

(h) Trapping data should be recorded on an appropriate trapping datasheet and in a database.

6.4 Removing animals from traps

All animal handling must be done by (or under the guidance of) trained and competent personnel. Techniques for removing animals from traps vary depending on the species

involved and the experience and skills of the animal handler. These notes are provided as a general guide only.

ANIMAL WELFARE: Capture myopathy is a condition which may be seen in many species of mammals and birds. It may be associated with:

- capture and restraint
- transport
- repeated handling
- placing animals in an unfamiliar environment or close confinement
- pursuit

Although it is mostly associated with prolonged muscle exertion, it may also be seen in animals experiencing fear or anxiety without physical exertion, as the physiological changes which occur are caused by prolonged and sustained adrenaline effects on the circulation, as well as muscle damage and lactic acid buildup (Vogelnest and Portas, 2008).

The condition can result in sudden death but death may also occur weeks after capture as a result of complications including organ failure and a loss of mobility which increases susceptibility to predation (Abbot *et al*., 2005).

Affected animals may exhibit panting, increased heart rate, shock, hyperthermia, muscle tremors and spasms, collapse, inability to hold the head up and inability to stand.

Capture myopathy carries a guarded to poor prognosis and management should focus on preventing its occurrence through efforts to minimise stress. Animals should only be handled for as long as required to identify them and to collect any necessary measurements (usually no more than five minutes). At a maximum they must be released (or reach alternate end point) within 24 hours of capture. Every effort should be made to avoid stressful events during hot weather.

Records of animals suspected to be suffering from capture myopathy need to be reported to the department's AEC. Any animal suspected to have died from capture myopathy must be sent for necropsy and a copy of the report provided to the department's AEC with an Adverse Event Form.

ANIMAL WELFARE: Ejection of pouch young is common in species of the Macropodidae, Potoroidae and Peramelidae families. Persons that may encounter species of these families whilst trapping must be familiar with the department SOP for *Care of Ejected Pouch Young*. Records need to be kept on orphans, their care and fate for annual reporting requirements for the department's AEC approved projects.

(a) Use handling bags appropriate for the species and length of containment as advised in department SOP for *Animal Handling and Restraint using Soft Containment*.

ANIMAL WELFARE: All handling bags and equipment should be kept clean to minimise risk of disease, contamination etc. Refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

(b) Remove animals from the trap as efficiently as possible.

(c) Keep traps covered as much as possible during removal of the animal to minimise stress.

(d) Small Cage: Animals should be encouraged to enter the handling bag by placing the bag over the end of the trap and manipulating the door to the open position. Lifting small cages with an animal inside should be avoided. Gentle encouragement via blowing on the animal (e.g. short, sharp breaths), using light and dark or positioning of the animal handler's body toward the rear of the trap can help.

(e) Check for dependent young after adult is removed from trap (inside the back of the trap, under hessian and beside the trap).

(f) Particular care should be taken for those species that may eject pouch young.

(g) Venomous or dangerous animals such as snakes should be released with consideration given to the best possible escape route for both animal and personnel. The door can be propped open to allow the animal to leave when the animal is ready. Similarly, the cage can be gently turned upside down from behind the cage with the aid of a long stick.

(h) Captured animals must be released at point of capture (unless the purpose of the trapping is translocation, specimen collection is required or other approved reason). Animals should be released as soon as possible and at an appropriate time of day or night. Animals must be released, or reach an alternate endpoint approved by the department's AEC, within 24 hours of capture. Animals should be released into good shelter where necessary and caution taken to reduce exposure to risks such as predation. Be aware of raptors in the vicinity when clearing traps.

(i) Where practical, non-targets, particularly birds, should be assessed for injury.

6.5 Picking up traps

(a) All traps must be counted out upon setting traps and counted in when picking up. Personnel undertaking the trapping should keep tallies of traps to ensure that all are collected and that there are no traps left behind. If traps are not being collected immediately after checking (i.e. traps are not being checked and picked up simultaneously), the traps must be closed on checking and remain closed until they are picked up. This is the responsibility of the person in charge at the survey location on the day. There is no excuse for leaving traps set in the field.

(b) Ensure residual bait is removed from traps and flagging tape is removed from the area.

7 Trap hygiene and maintenance

ANIMAL WELFARE: Traps and hessian covers must be cleaned and disinfected after each trapping session. Do not move dirty hessian covers and traps from one working site to another as it poses a disease risk for animal populations. To avoid possible transfer of pathogens use one batch of hessian covers and traps for each site or connected group of sites. Refer to the Department SOP for *Managing Disease Risk in Wildlife Management*.

(a) Traps must be maintained in good working order.

(b) In some instances, particularly traps that have held reptiles or brushtail possums, the trap will require faecal material to be removed within a trapping period. Particular attention should be paid to the release mechanism to ensure it is kept free of bait and scats. Also, clear the scats that can build up below the trap. Instructions on cleaning and disinfection

of traps are available in the department SOP for *Managing Disease Risk in Wildlife Management*.

(c) Hessian bags used as trap coverings should also be cleaned and disinfected after each trapping session following the instructions contained in the department SOP for *Managing Disease Risk in Wildlife Management*.

(d) Do not carry the traps by any of the moving parts and do not put any excessive weight into traps that will be carried. Minimise cage damage during transport in / on vehicles by orientating all cages in the same direction to prevent them catching on one another.

(e) Any damaged traps requiring attention need to be flagged and labelled in the field when a problem is identified so that it can be attended to and removed from use until repaired.

8 Competencies

A person who is competent has the knowledge, skills, and experiences that allow them to capture and handle animals successfully, and appropriately manage adverse events as required. Department personnel, and other external parties covered by the department's Animal Ethics Committee, undertaking projects involving cage traps require approval from the committee and will need to satisfy the competency requirements detailed in Table 1. Other groups, organisations or individuals using this SOP to guide their cage trapping activities are encouraged to also meet these competency requirements as well as their animal welfare legislative obligations.

It should be noted that sampling design details such as intensity and scope of the project being undertaken will determine the level of competency required and Table 1 provides advice for standard monitoring only.

Table 1 Competency requirements for Animal Handlers of projects using cage traps to capture fauna

Competency category	Competency requirement	Competency assessment
Knowledge	Broad understanding of the framework governing the use of animals in research and environmental studies in Western Australia	Training (e.g. DBCA Fauna Management Course or equivalent training). In applications, provide details on the course provider, course name and year.
	Understanding species biology and ecology	Personnel should be able to correctly identify the likely species to be encountered in cage traps for the site(s) being studied, and have an understanding of the species' biology and ecology. This knowledge may be gained through sufficient field experience and consultation of field guides and other literature.

	Understanding environmental conditions	Personnel should be aware of the environmental and seasonal conditions that may be expected on the project, and understand location-specific animal welfare considerations. In applications, provide details of time spent undertaking similar work in similar locations.
Fauna survey and capture skills/experience required	Experience setting and checking cage traps	Personnel should be familiar with the animal welfare principles of cage trapping (e.g. appropriate locations for trap installation, frequency of trap checking depending on climatic conditions, considerations for trap closure). In applications, provide details on the longevity, frequency & recency of experience.
Animal handling and processing skills/experience required	Experience handling terrestrial fauna	Personnel should be experienced at retrieving fauna from cage traps and restraint of the range of species likely to be captured. This experience is best obtained under supervision of more experienced personnel. In applications, provide details on experience relating to the expected species or species groups.
	Experience managing disease risk in wildlife management	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and consultation of literature.

In conjunction with possessing the required understanding and knowledge of cage trapping procedures and animal welfare requirements, a guide to the experience and skill requirements for an animal handler to be considered competent to capture and handle animals is as follows: (noting that some personnel with experience may still require initial supervision in unfamiliar locations or with species that they have not encountered previously):

- Total time in field: minimum 4-8 weeks undertaking cage trapping.
- Recency of time in field: within the past 5 years.
- Minimum 30 individuals of similar species handled.

9 Approvals

A licence or authorisation may be required under the *Biodiversity Conservation Act 2016* (examples below). Contact the department's Wildlife Licensing Section for more information. It is your responsibility to ensure you comply with the requirements of all applicable legislation.

- Fauna taking (scientific or other purposes) licence (Reg 25)
- Fauna taking (biological assessment) licence (Reg 27)
- Fauna taking (relocation) licence (Reg 28)
- Section 40 Ministerial Authorisation to take or disturb threatened species.

10 Occupational Health and Safety

The following departmental SOPs for wildlife survey and monitoring activities are relevant to occupational health and safety:

- SOP *Managing Disease Risk in Wildlife Management*
- SOP *Hand Restraint of Wildlife*

Departmental personnel, contractors and volunteers have duties and responsibilities under the Occupational Safety and Health Act 1984 and Occupational Safety and Health Regulations 1996 to ensure the health and safety of all involved. Fieldwork is to be undertaken in line with the department's corporate guidelines, policies and standard operating procedures, including but not limited to, risk management and job safety analyses. Further information can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/SOPs.aspx

If department personnel or volunteers are injured, please refer to the departmental Health, Safety and Wellbeing Section's 'Reporting Hazards, Near-misses and Incidents' intranet page, which can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/Reporting-Hazards,-Near-Misses-and-Incidents.aspx

11 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing to capture wildlife with cage traps:

- Department SOP *Soft Cage Traps for Capture of Macropods*
- Department SOP *Animal Handling and Restraint using Soft Containment*
- Department SOP *Care of Ejected Pouch Young*
- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk in Wildlife Management*
- Department SOP *Euthanasia of Animals Under Field Conditions*

For further advice refer also to:

Environmental Protection Authority and Department of Environment and Conservation (2020) *Technical Guidance - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, EPA, Western Australia.
National Health and Medical Research Council (2013) *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council.

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13 Glossary of Terms

Animal handler: A person listed on an application to the department's Animal Ethics Committee who will be responsible for handling animals during the project.
Cage trap: A trap for the live capture of animals constructed of wire mesh. Cage traps operate by the animal treading on a weight-sensitive trigger plate which causes the door to close and lock.

14 Appendix I: Universal Bait Recipe

Equipment

- Mixing bowl or bucket
- Mixing spoon (optional: can just use your hands)
- Container with lid to store bait
- Disposable gloves

Ingredients

- 500g Quick cooking oats
- 2 kg (5-6 375g tubs) Smooth peanut butter
- *Optional:* Between 110g (1 tin) and 636g (6-8 tins) Sardines (preferably in oil, or springwater)
- *Optional:* Cooking oil, preferably peanut oil
- *Note: Avoid using ingredients that contain additives, preservatives or artificial colours and flavours.*
- Serves: makes enough bait for approximately 100 cage traps for 4 trap nights.

Methodology

- Ensure personnel mixing bait are not allergic to peanuts.
- Place oats (and sardines if using) into clean mixing bowl or bucket and mix so that the sardines are well distributed though the oats.
- Mix in peanut butter until the oats and sardines are well distributed and the mixture is not too dry or too sticky. Form a ball that is sticky and cohesive. Keep in mind that the mixture will become drier over time as the oats absorb the oil from the peanut butter.
- Store bait in a sealed container.
- Clean bait mixing equipment.
- Add extra peanut butter if mixture becomes too dry. Water or cooking oil can be used if extra peanut butter is not available.

Optional: Bait can be pre-rolled.

Roll bait into balls ready for placing in traps (approx. 20c coin size for cage traps and 10c coin size for box traps). The bait balls can be counted to match the number of traps being set. This will ensure that you have enough bait for all traps being set and will also act as an additional check to ensure all traps have been set and baited.

Animal Welfare

To reduce the risk of impact of the use of universal bait on wildlife ensure that bait is stored for no longer than the specified period of 5 days fresh, or 3 months frozen, to avoid the risk of the components spoiling and being unsuitable for consumption. Where possible do not leave bait in open sun. Any old bait should be disposed of after trapping and not frozen for later reuse. Do not use bait or bait containers which contain mould.
Potential animal welfare impacts of mixing universal bait include:

- Food poisoning
- Changing behaviour by providing a food source

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Appendix 6: Animal Handling and Restraint Using Soft Containment

Standard Operating Procedure

SC22-12 ANIMAL HANDLING AND RESTRAINT USING SOFT CONTAINMENT

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes*.

Version 1.2

August 2022

GOVERNMENT OF WESTERN AUSTRALIA

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Please note: urls in this document which conclude a sentence are followed by a full point. If copying the url please do not include the full point.

Revision History Log

Version	Date	Details	Author/Reviewer	Approved By	Approval
1.0	2009	Draft created	C. Freegard and V. Richter	P. Orell and K. Morris	March 2009
1.1	16/05/2017	Changes to type of containment bags used and length of time animals can be held (see Table 1). Other minor revisions including clarification of procedures.	G. Yeatman, G. Anderson, and M. Page	M. Page	August 2017
1.2	30/07/2021	Revision of content & clarification of procedures	B. Palmer, N. Willers, A. Robey and F. Carpenter	M. Dziminski	August 2022

Approvals: Version 1.2

Approved by the DBCA Animal Ethics Committee:

Dr Martin Dziminski
Chair, Animal Ethics Committee
Department of Biodiversity, Conservation and Attractions

Contents

1 Acknowledgements

This standard operating procedure was originally developed by Christine Freegard and Vanessa Richter, with contributions from Claire Stevenson, Brent Johnson, Neil Thomas, Stephanie Hill and Peter Orell.

2 Purpose

Once an animal has been caught or trapped, it is usually transferred to some form of temporary containment such as a bag until it has been identified and processed. Soft containment aims to minimise stress to the animal whilst protecting it from injury, providing adequate ventilation and maintaining a comfortable temperature during measurement, observation and transport.

This Standard Operating Procedure (SOP) provides advice on how to handle and restrain animals using soft containment for processing in the field. For advice relating to longer term holding and transport of animals, refer to department SOP *Transport and Temporary Holding of Wildlife*.

3 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department of Biodiversity, Conservation and Attractions' (DBCA) Animal Ethics Committee (AEC). However, this SOP may also be appropriate for other situations.

This SOP applies to all fauna survey and monitoring activities involving the use of soft containment for animal handling and/or restraint undertaken across Western Australia by DBCA (hereafter department) personnel. It may also be used to guide fauna related activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All department personnel involved in fauna research and management should be familiar with the content of this document.

Projects involving wildlife may require a licence/authorisation under the *Biodiversity Conservation Act 2016*. Personnel should consult the department's Wildlife Licensing Section and AEC Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for all AEC approved projects. A copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

4 Animal Welfare Considerations

To reduce the level of impact of animal handling and restraint using soft containment on the welfare of animals, personnel must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented during animal handling and contingencies for managing welfare issues have been identified. Ensure that all handlers and volunteers involved in the project are aware of the range of issues that they may encounter, the options that are available for reducing impacts and improving animal welfare, and the process for managing adverse events.

Department projects involving animal handling will require approval from the department's AEC.

Key animal welfare considerations that should be considered when handling animals using soft containment are listed below and highlighted throughout the document.

Injury and unexpected deaths

If adverse events including injury, unexpected deaths or unplanned requirement for euthanasia occur then it is essential to consider the possible causes and take action to prevent further issues. Adhering to the guidance in this SOP will assist in minimising the likelihood of adverse events. For projects approved by the department's Animal Ethics Committee, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the department SOP for *Euthanasia of Animals Under Field Conditions*. Where disease may be suspected, refer to the department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

Level of impact

Potential impacts of soft containment of animals include:

- Capture myopathy (in some species)
- Distress
- Physical injury, pain or discomfort
- Hyperthermia
- Hypothermia
- Death

How an animal is handled will directly affect the level of impact on the welfare of the animal. If appropriate soft containment methods are used and appropriate care is provided then the level of impact of soft containment is low.

5 Approved Soft Containment Methods

All soft containment methods described in this SOP are for the restraint of animals during processing in the field. The appropriate containment method depends on the size and comfort requirements of the animal as well as its ability to escape. For example, animals with large claws need to be contained in a bag that will not easily be torn, and animals stressed when eyes are uncovered require a bag made of a dense weave fabric that effectively blocks light. Table 1 summarises the approved methods of soft containment. If restraint time for processing must be longer than the maximum holding time specified in Table 1, this must be justified in the application to the department's AEC. See SOP *Transport and Temporary Holding of Wildlife* for advice on holding animals for longer periods than immediate processing.

ANIMAL WELFARE: Consider your research question when planning your animal handling. Animals must only be handled, and measurements taken if it forms part of the aims of your project. Do you need to weigh? Do you need to measure body morphometrics?

Table 1 Approved soft containment methods and their uses

Purpose of containment	Material	Dimension (length x width)	Species	Holding Time	Cautions and Notes
Obtaining weight	Lightweight clear, plastic bag (eg ziplock, freezer)	≤ 16 x 10 cm	Frogs, reptiles (< 30 g)	< 30 seconds	Due to their light weight, small plastic bags can be used for increased precision in weighing small vertebrates. This should be done just prior to releasing the animal to reduce handling individuals multiple times. Care should be taken to not expose animals to direct sunlight or heat and time should be extremely short - only as long as it takes to weigh and then immediately release. Bags should be kept clean, dry and replaced as necessary.
Holding for processing in the field.	Lightweight clear, plastic bag (eg ziplock, freezer)	As suitable for species.	Moist-skinned frogs (e.g., *Crinia, Litoria* sp.)	Up to 5 minutes	Bags should remain inflated. Keep animals out of direct sunlight/heat while in a plastic bag. Consider providing some moisture or substrate in the bag as appropriate for the species and situation. Bags should be kept clean and replaced as necessary.
Holding for processing in the field.	Calico bag	Small, ≥ 30 x 25 cm (to fit opening of medium Elliott trap)	Small birds, mammals (e.g., rodents, small dasyurids), reptiles & dry-skinned burrowing frogs (e.g., *Heleioporus* sp.)	Up to 5 minutes	Animals should be transferred into calico bags upon capture/removal from trap/net. Take care to check bags for holes, weak seams and loose threads. Be aware that mammals, particularly rodents, may chew through bags and escape. See SOP *Mist Net Trapping for Birds* for advice on containment of birds for processing.
		Large, ≥ 75 x 55 cm (to fit opening of a cage trap)	Larger birds, reptiles and rodents		
Holding for processing in the field.	Dark heavy cotton drill, denim or synthetic (e.g., polar fleece)	≥ 75 x 55 cm (to fit opening of a cage trap)	Medium-sized mammals (e.g., brushtail possums, bandicoots, bettongs, quolls)	Up to 5 minutes	Take care to check bags for holes, weak seams and loose threads. Darker bags can quickly calm animals but take care to ensure animals do not overheat.
Holding for processing in the field.	Dark heavy cotton drill, denim.	Dependant on species size and trap type/size.	Larger macropods (e.g., quokka, wallabies, kangaroos)	Up to 5 minutes	Take care to check bags for holes, weak seams and loose threads. Macropods can have sharp claws that tear bags, fabric must be of suitable strength. Darker bags can quickly calm animals but take care to ensure animals do not overheat.

6 Procedure Outline

Care and storage of handling bags

Prior to fieldwork, check bags are disinfected, clean and dry, and tie strings are present. Also check for holes, weak seams and loose threads. Wherever possible, have the bags made with both the seams and tie-string on the outside or have the seams pipe-stitched.

After field work, wash and disinfect all used bags, discard or repair damaged bags and arrange replacement bags as required. Refer to department SOP for *Managing Disease Risk and Biosecurity in Wildlife Management* for further guidance on cleaning and disinfecting bags.

Bags must be stored in a clean, dry, pest free location.

Transferring animals into handling bags

To minimise stress, all animals should be transferred to an appropriate handling bag as soon as possible after capture. Methods used to transfer the animal into the holding bag will depend greatly on the species and the process that was used to capture the animal. Ensure that no part of the animal's body is caught or tangled in the bag when the bag is closed and tied.

Handling animals in bags

ANIMAL WELFARE: All animal handling must only be undertaken by, or directly supervised by, competent and experienced personnel who are familiar with the normal behaviour patterns of the species under restraint.

Always ensure the following when handling animals in bags:

- Avoid excessive noise and sudden movements.
- Smoking and eating is not acceptable immediately prior to, or when handling animals.
- Handling and restraint times should be kept to a minimum.
- Animals can bite through bags, so be aware at all times of the location of the head to minimise chances of being bitten.

General advice on hand restraint of different groups of animals can be found in the department SOP for *Hand Restraint of Wildlife*.

Once in the bag, most mammals are best handled by first directing the head into a corner of the bag. Ensure that the animal can breathe and is not forced into awkward or unnatural positions that may cause injury.

Mammals should generally be handled in bags that block visibility, and be positioned so that the bag can be opened to only expose the area of interest. Eyes should be kept covered as much as possible during handling to aide in reducing stress, and the chance of escape.

Note: frogs, reptiles and birds are generally processed out of the holding bag.

Where multiple animals are being collected and held in bags, processing must be undertaken methodically and as quickly and efficiently as possible to ensure that no animals are forgotten and that all animals are released as soon as possible.

Always check the inside of a bag before and after releasing an animal to ensure that no young are left behind. Ejection of pouch young is common in species of the Macropodidae, Potoroidae and Peramelidae families.

ANIMAL WELFARE: To ensure minimal stress to the animals, they should only be handled for as long as required for identification, marking and measurements (usually no more than five minutes). Ensure noise and other disturbance is kept to a minimum.

Care of animals in bags

Note: The following is general advice only. Depending on various factors, including species and weather, a bagged animal may need to be cared for in different ways.

It is preferable to only contain a single animal per bag. If more than one animal is contained in a bag, ensure that animal sizes and species are not mixed. It may be appropriate to contain female marsupials and their large pouch young in the same bag for soft release, refer to department SOP *Care of Ejected Pouch Young* for further guidance.

Animals in bags must be placed and secured where they cannot be inadvertently injured by the bag moving or other objects constricting or crushing the bag, where they will not be exposed to extreme temperatures (hot or cold), accidentally forgotten or stepped on and will not be threatened by predators or harm each other.

ANIMAL WELFARE: Overheating can lead to death. Temperature management is essential; soft containment bags should never be left in direct sunlight. Under extreme conditions (e.g., >35°C) additional mitigation measures should be applied.

ANIMAL WELFARE: On cool days, if individuals appear to be suffering from the cold (shaking, unsteady on feet, in torpor) it may be necessary to gently warm small birds and mammals inside the bag, under jumpers or clothing prior to release. Refer to department SOP *Care of Ejected Pouch Young* for further guidance on ejected pouch young.

Keep bags well-ventilated.

Tying and labelling bags

(a) A bag holding any animal must be tied securely but in such a way that the knot can be easily undone when access to the animal is needed (e.g., a firm bow). Preferably, the opening of the bag should be folded over and tied.

Small snakes (particularly blind snakes), and even other slender reptiles can escape through poorly tied bags, so it is recommended that the opening of the bag is always folded prior to being tied for these species. Ensure the animal is in the bottom of the bag and no part of it can be inadvertently caught when tying the bag.

(b) If an animal is not being processed and released immediately then its bag must be labelled. In most circumstances, it is best to write the relevant details in permanent marker on flagging tape and securely tie the tape to the bag, although writing can also be done directly on the bag, usually in pencil. It is important to make sure any prior writing is crossed out so there can be no confusion.

(c) Generally, details should include date, location (site), species, individual identification (e.g., ear tag, if necessary/available), number of individuals in the bag, and if the animal

is venomous. However, information recorded on labels depends on the purpose for holding the animals. If an animal is only being held for identification and measuring, it may be sufficient to note only the trap number so that the animal can be released at its point of capture once it has been processed.

(d) If multiple animals are being captured and held for transport, use different coloured flagging tape to differentiate between males and females. This helps sort animals if a particular sex ratio is desired. It also helps to identify which animals are female, as they may require extra care, particularly for species that eject pouch young.

(e) For vouchering: See the department SOP on *Vouchering Vertebrate Fauna Specimens* for more information.

7 Competencies

A person who is competent has the knowledge, skills, and experiences that allow them to successfully capture and appropriately handle animals for the required use, and effectively manage adverse events or mitigate risks as required. Department personnel, and other external parties covered by the department's AEC, undertaking projects involving soft containment of animals require approval from the committee and will need to satisfy the competency requirements (Table 2). Other groups, organisations or individuals using this SOP to guide their animal handling and restraint activities are encouraged to also meet these competency requirements as well as their animal welfare legislative obligations.

It should be noted that sampling design details such as intensity and scope of the project being undertaken will determine the level of competency required and Table 2 provides advice for standard monitoring only.

Table 2 Competency requirements for Animal Handlers of projects involving soft containment of animals

Competency category	Competency requirement	Competency assessment
Knowledge	Broad understanding of the framework governing the use of animals in research and environmental studies in Western Australia	Training (e.g., DBCA Fauna Management Course or equivalent training). In applications, provide details on the course provider, course name and year.
	Understanding species biology and ecology	Personnel should be able to correctly identify the likely species to be encountered for the site(s) being studied and have an understanding of the species' biology and ecology. This knowledge may be gained through sufficient field experience and consultation of field guides and other literature.

	Understanding environmental conditions	Personnel should be aware of the environmental and seasonal conditions that may be expected on the project and understand location-specific animal welfare considerations. In applications, provide details of time spent undertaking similar work in similar locations.
Animal handling and processing skills/experience required	Experience handling terrestrial fauna	Personnel should be experienced in handling, restraint and measuring of the range of species likely to be captured whilst minimising stress to the animal. This experience is best obtained under supervision of more experienced personnel. In applications, provide details on experience relating to the expected species or species groups.
	Experience managing disease risk in wildlife management	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and consultation of literature.

In conjunction with possessing the required understanding and knowledge of animal handling and restraint using soft containment procedures and animal welfare requirements, a guide to the experience and skill requirements for an animal handler to be considered competent to handle and restrain animals using soft containment is as follows: (noting that some personnel with experience may still require initial supervision in unfamiliar locations or with species that they have not encountered previously):

- Total time in field: minimum 3-6 weeks undertaking animal handling and restraint using soft containment with similar species.
- Recency of time in field: within the past 5-7 years.
- Minimum 20 individuals of similar species handled.

8 Approvals

A licence or authorisation may be required under the *Biodiversity Conservation Act 2016* (examples below). Contact the department's Wildlife Licensing Section for more information. It is your responsibility to ensure you comply with the requirements of all applicable legislation.

Fauna taking (scientific or other purposes) licence (Reg 25)
Fauna taking (biological assessment) licence (Reg 27)
Fauna taking (relocation) licence (Reg 28)
Section 40 Ministerial Authorisation to take or disturb threatened species.

9 Occupational Health and Safety

The following departmental SOPs for wildlife survey and monitoring activities are relevant to occupational health and safety:

SOP *Managing Disease Risk in Wildlife Management*
SOP *Hand Restraint of Wildlife*

Departmental personnel, contractors and volunteers have duties and responsibilities under the *Occupational Safety and Health Act 1984* and *Occupational Safety and Health Regulations 1996* to ensure the health and safety of all involved. Fieldwork is to be undertaken in line with the department's corporate guidelines, policies and standard operating procedures, including but not limited to, risk management and job safety analyses. Further information can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/SOPs.aspx
If department personnel or volunteers are injured, please refer to the departmental Health, Safety and Wellbeing Section's 'Reporting Hazards, Near-misses and Incidents' intranet page, which can be found at https://dpaw.sharepoint.com/Divisions/corporate/people-services/HS/SitePages/Reporting-Hazards,-Near-Misses-and-Incidents.aspx

10 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing to handle and restrain animals using soft containment:

Department SOP	*Hand Restraint of Wildlife*
Department SOP	*First Aid for Animals*
Department SOP	*Managing Disease Risk and Biosecurity in Wildlife Management*
Department SOP	*Euthanasia of Animals Under Field Conditions*
Department SOP	*Vouchering Fauna Specimens*

For further advice refer also to:

National Health and Medical Research Council (2013) *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council.

11 Glossary of Terms

Animal handler: A person listed on an application to the department's Animal Ethics Committee who will be responsible for handling animals during the project.

Appendix 7: Protocol Registration Forms

BILBY PRE-CLEARANCE SURVEY RECORD SHEET

Date			
Time Survey Commenced			
Time Survey Concluded			
Survey Area GPS Coordinates	Easting	Northing	
Area Surveyed (ha)			
Name of Surveyor(s)			
Bilby Observations			
Evidence of Bilbies Observed (please circle)	Yes (Fill in the Bilby Observations Record Sheet)	No	
Potentially Active Burrows (please circle)	Yes (Fill in the Burrow Camera Monitoring Record Sheet)	No	
Inactive Burrows (please circle)	Yes (Fill in the Burrow Collapsing Record Sheet)	No	
Other Fauna Observations			
Evidence of Other Fauna Observed	Yes	No	
Fauna Species Observed			
Capture and Translocation Required?	Yes (Fill in Bilby Capture and Release Record Sheet)	No	

BILBY OBSERVATIONS RECORD SHEET

DATE		NAME OF OBSERVER(S)					
Time	GPS Coordinates		Sign Type (Burrows, Tracks, Scats, Diggings)	Estimated Age of Sign (or Time Since Last Use)	Abundance of Signs	Notes	Status (If Burrow)
	Easting	Northing					

BURROW CAMERA MONITORING RECORD SHEET

Collect time-and-date stamped images of Bilbies leaving burrows and not returning.

This record sheet should be used when monitoring potentially active burrows, and monitoring Bilby release sites.

Burrow ID		**GPS Coordinates**				**Observer(s)**	
		Easting		**Northing**			

Date	**Bilby Observed**	**Other Fauna Observed**	**Comments**
	Yes / No	Yes / No	
	Yes / No	Yes / No	
	Yes / No	Yes / No	
	Yes / No	Yes / No	
	Yes / No	Yes / No	
	Yes / No	Yes / No	
	Yes / No	Yes / No	

Action Required (please circle)	Bilby Translocation or Inactive Burrow Collapsing	**Date Completed**	

BURROW COLLAPSING RECORD SHEET

Date		Collapsed By	

Burrow ID	GPS Coordinates		Fauna Encountered	Notes
	Easting	Northing		

BILBY CAPTURE AND RELEASE RECORD SHEET

Capture Location				**Date**	
Easting		**Northing**			
Personnel Name					
Capture Time		Release Time			
Release Location					
Easting		**Northing**			
Health Status					
Sex (please circle)	Male / Female	**Pouch Dependent Young (please circle)**	Yes / No		
Notes					

FAUNA FIRST AID TREATMENT RECORD SHEET

Location Found				**Date**	
Easting		**Northing**			
Treatment Given By		**Injuries?**			
Species					
Sex (please circle)	Male / Female	**Pouch Dependent Young?**	Yes / No		
On-Site First Aid Treatment					
Off-Site Rehabilitation Required?	Yes / No	Organisation Transferred To		Transport Details	
Release Adjacent to Activity Area	Yes / No	Release Location		Release Details	
Notes					

FAUNA DEATH RECORD SHEET

Location Found				**Date**	
Easting		**Northing**			
Found By					
Species					
Sex (please circle)	Male / Female	**Pouch Dependent Young?**	Yes / No		
Euthanised	Yes / No	**Method**			
Likely Cause of Mortal Injury/Death					
Notes					